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MIGRATIONS OF SIOUAN TRIBES.[1]

BY REV. J. OWEN DORSEY.

"SIOUAN" is the term adopted by the Bureau of Ethnology instead of "Dakotan," as the name of the linguistic family of which the Sioux or Dakotas have been regarded as the leading nation.

The tribes whose migrations are described in this paper are the Ponkas, Omahas, Osages, Kansas, Kwapas, Iowas, Otos, Missouris, Winnebagos and Mandans. The other tribes of this family are the Sioux, Assiniboins, Hidatsas, Crows and Tutelos.

Some authors speak of a series of migrations of these tribes from the west toward the east, but the writer has not been able to learn on what authority such statements have been made, nor has he ever found any tradition of such eastward migrations among the tribes that he has visited.

Whatever may be the value of Catlin's map of the Mandan migrations, there can be no doubt that the Mandans belong to the Siouan family. Their language shows unmistakable resemblances to the Winnebago, as well as to the Dakota, Osage, Kansas, etc. The Mandan tradition, as given to Catlin, placed the ancestors of that people east of the Mississippi river at an early day (Catlin's N. A. Indians, II, 259).[2]

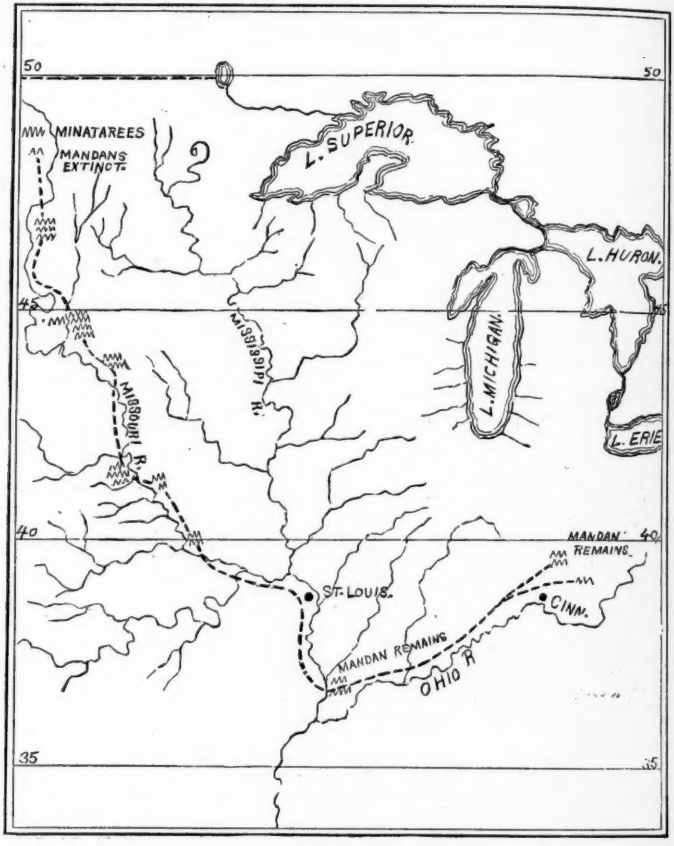
The Jesuit Relation of 1640 speaks of the Dakotas and Assiniboins, placing them in the neighborhood of the Winnebagos. This last nation was probably in the region of Green bay in 1614,

[1] Read before the Anthropological Society, Washington, D. C., in 1884.

[2] See map 2.

when Champlain met eight of their men. They are also mentioned in 1620. In 1680 Father Membré said that they were near the Kickapoos. In 1766 Carver found them about thirty-five miles from Green bay.

MAP 2.



Part of Catlin's map, showing the course of the Mandans.

About three years ago the Iowa chiefs who visited Washington at that time told the writer that their people, the Otos, Missouris, Omahas and Ponkas once formed part of the Winnebago nation. In confirmation of this note are the following statements: (*a*) About the year 1848 Rev. Wm. Hamilton, missionary to the

Iowas, learned that when they sung their mystic songs they used the Winnebago language. (*b*) A careful study of the languages of the Iowas, Otos and Winnebagos shows that they are very closely related; indeed, time may prove the necessity of including them in one group instead of two. (*c*) We have the tradition given by the Prince of Nieu Wied on p. 645 of his first volume (German edition). (*d*) Gallatin (Trans. Amer. Antiq. Soc., 1836, p. 127) says that the Iowas, Otos, Missouris, Omahas and Ponkas have a tradition that, at a distant epoch, they, together with the Winnebagos, came from the north; that the Winnebagos stopped on the banks of Lake Michigan while the rest, continuing their course southerly, crossed the Mississippi river and occupied the places in which they were found by the Europeans. (*e*) There is a statement made in Maj. Long's account of his expedition to the Rocky mountains, 1819 (ed. by James), of which the substance is now given: "The parent nation originally resided somewhere north of the great lakes. On moving southward a large body seceded, staying on the shore of a lake; these became the Ho-chan-ga-ra or Winnebagos. Another band separated from the main body on reaching the Mississippi—these became the Iowas (Pa-kho-che). At the mouth of the Missouri another band stopped and made a village, hence their name, "Ne-o-ta-che" (Ni-u-t'a-chi), now called Missouris. The Otos (Wa-to-ta, lovers of sexual pleasure) left the nation on the Mississippi (according to another account they seceded from the Missouris at the mouth of the Missouri river) and went across the country till they struck the Missouri near the mouth of the Great Nemaha. Here they remained a long time. Thence they went up to the Platte, and after hunting for some time near its mouth they moved further up the Missouri and built a village on the right bank of that river, about fourteen miles below Council Bluffs, Ia. While they were there a band of Iowas established themselves on the bank of the river, nearly opposite to them and within thirty miles of the site of the Omaha village, in 1819. The Otos subsequently removed to the Platte, about twenty miles above the village occupied by them in 1819, but finding the latter situation a better one, they established themselves there (about A. D. 1769)."

"The Iowas, after remaining in a village on the Lower Missouri for a long time, were rejoined by the band above mentioned, when they returned to the Mississippi and erected a village on the Moyene,"

This must refer to a late period in the history of the Iowas, extending back, perhaps, not further than 1740 or 1750. This will appear the more plainly after comparing the above statement respecting the Otos with the map of the migrations of the Iowas given as Plate xxx in Vol. III of Schoolcraft's Archives of Aboriginal Knowledge. A copy of the map accompanies this article. The supposition of the writer is also in accordance with what follows about the migrations of the Iowas in company with the Omahas and Ponkas.

"The Missouris in course of time abandoned their village at the mouth of the Missouri, and gradually ascending the river at length built a town on the left bank, near the mouth of Grand river. They were found there by the French, who built a fort on an island in the Missouri, very near them, about the beginning of the last century. * * * The Missouris continued to dwell in the same locality until, about twenty years since (A. D. 1798, 1799 or 1800), they were conquered and dispersed by a combination of the Saks, Foxes and some other Indians. Five or six lodges joined the Osages, two or three took refuge with the Kansas, and the chief part of the remainder amalgamated with the Otos."

In 1673 the Otos were placed by Marquette[1] between 40° and 41° N. lat., west of the Missouri and Mississippi rivers, east of the Maha (Omahas) and south-east of the Pana (Ponkas?). The Iowas, according to the same authority, were between 40° and 41° N. lat., north-west of the Maha and west of the Pana. In 1680 the Ainoves (Iowas) were east of the Mississippi and near the Kickapoos, according to Membré (see Shea's Discov. and Expl. Miss. Valley, p. 150). The Otos were "one hundred and thirty leagues from the Illinois, almost opposite the mouth of the Miskoncing." In 1687 the Otos were on the Osage river. In 1700 Iberville said that the Otos and Iowas were with the Omahas between the Missouri and Mississippi rivers, about a hundred leagues from the Illinois. In 1721 the Iowas were east of the Missouri river, above the Otos and below the Pawnees, being allies and neighbors of the Dakotas. The Otos were below the Iowas and above the Kansas, on the west side of the Missouri (Charlevoix, Histor. Journal, p. 294).

The Ponkas told Rev. A. L. Riggs that their ancestors used to dwell east of the Mississippi. They subsequently inhabited the

[1] See his autograph map in Shea's Discov. and Explor. of the Miss. Valley. 8vo, p. 268. N. Y., 1852.

country on the north side of the Missouri river, near its mouth. The Kansas and the Osages were the first to depart; then the Omahas and Ponkas followed the course of the Missouri towards its head. Mr. Riggs also says that the Ponkas went to the region of the Black hills, and were there before the Crows; but the Ponkas told the writer that the Crows inhabited that country and were owners of the Black hills when their ancestors arrived there, at which time there were no Dakotas in that region. This last statement is confirmed by the Dakota winter-counts in Dr. Corbusier's collection. The writer was also told that the Ponkas used to dwell north-east of the old Ponka reservation (which is in Todd county, Neb.), in a land where they wore snow-shoes. Since 1879 the writer has gained more definite information from other Ponkas, as well as from Omahas, Osages and Kansas, and it is now given.

Ages ago the ancestors of the Omahas, Ponkas, Osages, Kansas, Kwapas, Winnebagos, Pawnee Loups (Skidi) and Rees, dwelt east of the Mississippi. They were not all in one region, but they were allies, and their general course was westward. They drove other tribes before them. Five of these peoples, the Omahas, Ponkas, Osages, Kansas and Kwapas, were then together as one nation. They were called Arkansa or Alkansa by the Illinois tribes, and they dwelt near the Ohio river. At the mouth of the Ohio a separation occurred. Some went down the Mississippi, hence arose their name, "U-ga'-qpa (Oo-ga-khpa)" or Kwapa (Quapaw), meaning "the down-stream people." This was prior to 1540, when De Soto met the Kwapas, who were then a distinct tribe.

The rest of the Arkansas ascended the river, taking the name of U-ma^{n}'-ha^{n} (Omaha), "those going against the wind or current."

These names—Kwapa and Omaha—are of more recent origin than Kansas, Osage and Ponka. We find proofs of the antiquity of these three names in the names of gentes in these tribes. Thus among the Ponkas there is a Ponka gens (the Ma-ka^{n}), and an Osage gens (the Wa-ja-je). The Omahas have a Kansas gens (the ꓘa^{n}-ze). The Kansas have a Ponka gens (Cedar people), an Osage gens (Deer people), and a Kansas gens (ꓘa^{n}-ze, associated, as among the Omahas, with the winds). The Osages have a Kansas gens (Ka^{n}-se) and seven Osage (Wa-ɔa-ɔe) gentes, one

of which is the Ponka (Pa^{n}-ʜka). The last is associated with the red cedar. If the true meanings of the three names have been preserved, they can be gained only in one way—by questioning members of the secret societies in the tribes.

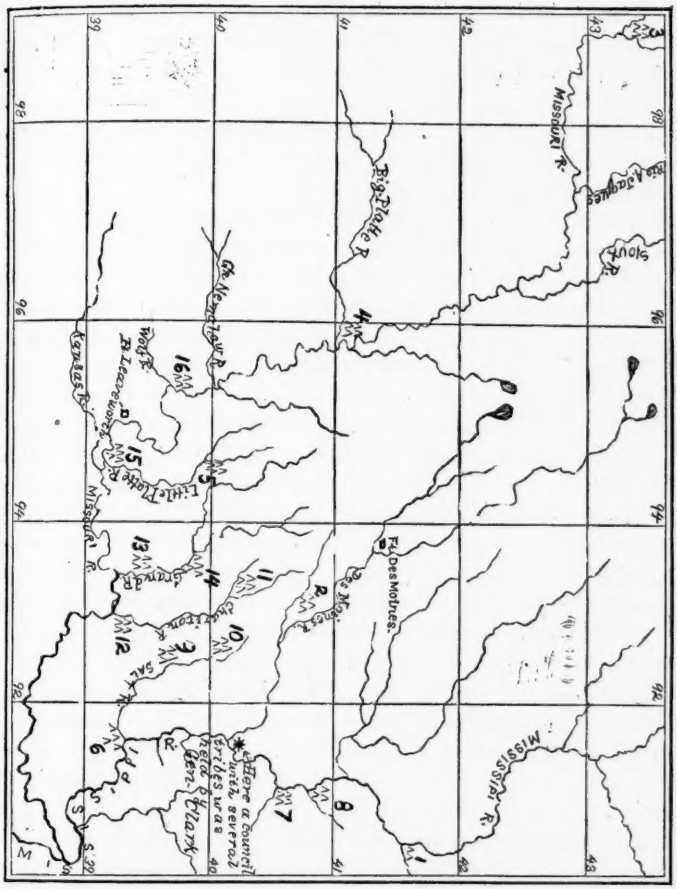
The writer has been unable to find an Omaha gens, and the only Kwapa village (not a gens) is among the Kwapas.

Joutel names four Kwapa villages—Otsote, Thoriman, Tonginga and Cappa. The first village is called by other French writers, Otsotchave, or Otsotchoue, the third, Topinga (evidently a printer's error), and the fourth, Kapaha. According to Shea these divisions of the Arkansas are extinct, but the writer has been able to find members of them still existing. When he was at the Osage agency, Indian Terr., in 1883, he met three Kwapas. From two of them he gained the following: The first village is U-ga′-qpa-qti, real Kwapas (Cappa or Kapaha). The second is U-zu′-ti-u′-hi (Otsote), which may mean village along an *uzu* or lowland level containing trees here and there. The third is Ti′-u-a′-d^{dh}i-ma^{n}′ (Thoriman). The name of the fourth village could not be learned from the Kwapas; but Margry tells us that it meant "small village" in the Kwapa dialect. The writer finds that this would be expressed by Ta^{n}′-ma^{n} ji′-gă, with which compare Tonginga and Topinga. In July, 1687, according to Joutel, two of these villages were on the Arkansas river, and the others were on the Mississippi. A visit to the Kwapas might furnish the writer with their traditions, etc. Though they must have separated from the Ponkas more than three hundred years ago, the dialects are still so similar that the Kwapas met by the writer could understand him very easily when he spoke to them in Ponka.

The Omahas and their associates followed the course of the Mississippi till they reached the mouth of the Missouri, remaining for some time near the site of the present city of St. Louis. Then they ascended the Missouri to a place called Tce-dŭñ′-ga a′-ja-be and Ma^{n}′da-qpa′-yĕ by the Kansas, and Ma^{n}′-ɻa-qpa′-dhĕ by the Osages. This was an extensive peninsula on the river, having a high mountain as a landmark.[1]

[1] The writer was told by an Osage that Ma^{n}-ɻaqpadhĕ was at Fire Prairie, Missouri, where the first treaty with the Osages was made by the United States. But that place is on a creek of the same name which empties into the Missouri river on the south, in T. 50 N., R. 28 W., at the town of Napoleon, Jackson county, Mo. This could not have been the original Ma^{n}-ɻaqpadhĕ. Several local names have been duplicated

MAP 3.



Map of the country formerly occupied by the Ioway tribe of Indians, from a map made by Waw-non-qwe-skoon-a, an Ioway brave. Drawn by Capt. S. Eastman, U.S.A. (Plate XXX, Vol. III, p. 256, Archives of Aboriginal Knowledge, by H. R. Schoolcraft. No. 3, according to the Iowa Indian, was near the great Pipestone quarry. The real place of the quarry was further east, at No. 15, of Map 1. It is very probable, that No. 3 of Map 3 was near the White river, Dakota, and if so, it may have been the same as No. 19 of Map 1.

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by the Kansas during their wanderings, and there are traces of similar duplications among the Osages. Besides this the Omahas and Ponkas never accompanied the Kansas and Osages beyond the mouth of the Osage river, and the Kansas did not reach the vicinity of Napoleon for some time after the separation at the mouth of the Osage river.

Here, according to the Kansas and Osages, the ancestors of the four tribes dwelt together. In the course of time they ascended the Missouri and established themselves at the mouth of the Osage river. The Iowas were near them; but the Omahas say that at that period they did not know the Otos and Missouris. At the mouth of the Osage river the final separation occurred. The Omahas and Ponkas crossed the Missouri, resuming their wanderings. The Osages ascended the stream bearing their name, and at a tributary, called by them "Tse′-ɬū^{n}-ɻa′-qa," they divided into the ɻa-he′-ɬsi (those who camped at the top of the mountain), incorrectly styled Great Osages, and the Ü-ɬsĕʜ′-ta (those who camped at the base of the mountain), popularly called Little Osages. The Kansas ascended the Missouri on the south side till they reached the Kansas river. A brief halt was made, and the journey was resumed. They ascended the Missouri on the east side till they reached the present northern boundary of the State of Kansas. There they were attacked by the Cheyennes, and were compelled to retrace their steps. They settled again at the mouth of the Kansas, till the "Big Knives" came with gifts and induced them to go further west. Their subsequent history, as given to the writer by two chiefs, contains an account of about twenty villages along the Kansas river, then the settlement at Council Grove, Kas., and finally the removal to their reservation in Indian Terr.

Let us return to the Omahas and Ponkas. After crossing the Missouri they were joined by the Iowas, according to Two Crows and Joseph La Flèche, of the Omahas. They said that this addition to the party was made about the time of the separation from the Osages and Kansas. But the Iowa tradition, as given to Mr. Hamilton (see map of the Iowa brave) places the first village of that tribe west of the Mississippi, on the Des Moines river. The two Omahas just named said that their fathers followed the tributaries of the Missouri till they reached the great Pipestone quarry in Minnesota. Other Omahas have said that the course was up the Des Moines river, which would naturally bring the wanderers near the quarry. The writer is inclined to believe that they ascended the Chariton river, and when at its source they would be near the Des Moines. As the Iowas were a cognate tribe, it was reasonable for them to unite with the others. At all events the traditions agree in this: the people built earth lodges (perma-

nent villages), they farmed and hunted the buffalo and other animals. When the game became scarce in their neighborhood, they abandoned their villages and went north-west. On reaching a place near the new haunts of the game, other permanent villages were built and they were occupied for years. So they lived till they reached the Pipestone quarry (which is not given in the right place on the Iowa map). When they arrived at the Big Sioux river they built a fort. At that time the Yankton Dakotas dwelt in a forest region of Minnesota, near the Mississippi, and were called "Ja^{n}′-a-ɬa ni′-ka-ci^{n}′-ga, people (dwelling) in the woods." By and by the Dakotas made war on the Omahas and their allies, defeating them and killing about a thousand warriors. This obliged the three tribes to abandon their habitat. They fled south-west till they reached the lake where the Omahas and Ponkas obtained their sacred pole. This is now called Lake Andes, and it is at the head of Choteau creek, Dakota. There the sacred pipes were given, according to the Omaha and Ponka traditions, and the present gentes were constituted. From this place they ascended the Missouri river till they reached White river (Ni-u′-ga-cu′-de). There the Iowas and Omahas remained, but the Ponkas crossed the Missouri near the mouth of the White river, and went on to the Little Missouri river and the country near the Black hills. They subsequently rejoined their allies and all descended the Missouri on its right bank. When they reached the mouth of the Niobrara river the final separation was made. The Ponkas remained there. The Omahas settled on Bow creek, Neb., which they called "Village stream." The Iowas advanced to the stream on which is situated the town of Ionia, Dixon county, Neb., hence its name, "where the Iowas farmed." By and by the Omahas removed to a place near Covington, Neb., which is opposite Sioux City (see 24 on Map 1). The remains of this village are known as ⱡi ɬañ-ga jiñ-ga, and the lake near by is called "Dhix-u-cpa^{n}-u-gdhe," because of the willows along its banks.

In the course of time the Iowas passed the Omahas again and made a village near the place where Florence, Neb., now stands. After that they continued southward till they reached their reservation at the Nebraska and Kansas line. The Otos were first met by the Omahas, according to Mr. La Flèche, in comparatively recent times on the Platte river.

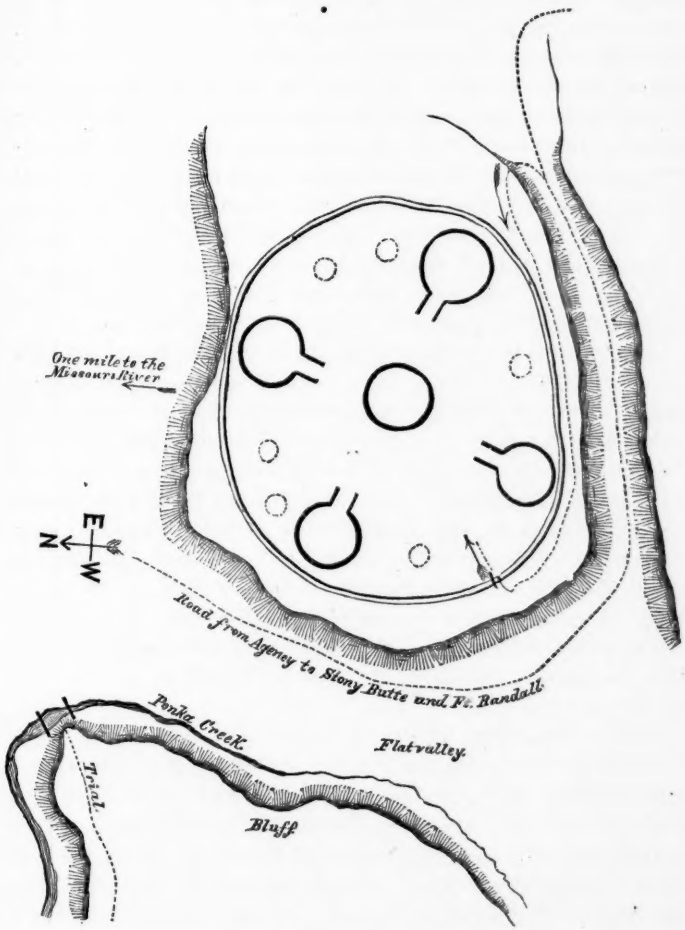
Subsequent Migrations of the Omahas.—After leaving ⊥i ꞑañga jiñga (No. 24), where the lodges were made of wood, they dwelt at Zande buꞑa. This is south-east of ⊥i ꞑañga jiñga, and is the name of a stream as well as of a prominent bluff near by. This stream empties into Omaha creek near the town of Homer, Neb. After a great freshet the Omahas crossed Omaha creek and made a village at or near Omadi, which was called *Large village*, near *Village stream* (Omaha creek). See No. 25 on Map 1. This was a favorite resort, as we shall see. Thence they removed to Bell creek, on the west side of which they made a village (No. 26). Thence they went south to Salt creek, below Lincoln (No. 28). Thence they returned to *Large village* (No. 25). When they were there, Half-a-day, the aged historian of the tribe, was born. This was about A. D. 1800. Thence they removed to A-ne na-t'ai dha^{n}, *where the people perished in a prairie fire*, a hill on the Elkhorn river (No. 30). They stayed there five years. Then they settled on Shell creek, which they called Tacnañguji (No. 31). After which they returned to *Large village* (No. 25). Leaving this again, they made a village on the Elkhorn, near Wisner (No. 33), about A. D. 1822–3. Half-a-day married when he was there. About A. D. 1832–3 they returned to *Large village* (No. 25). Joseph La Flèche remembers having been there at that time. About A. D. 1841 they removed to Ta^{n}-wa^{n} jiñga dha^{n}, the Small village (No. 35), at the mouth of Logan creek, where they dwelt for two years. In 1843 they returned to Large village (No. 25), and in 1845 they made a village on the curvilinear top of a plateau, near Bellevue (No. 37). In 1855 they removed to their present reservation.

The Ponkas did not occupy their new country unmolested. They had some fights with the Cheyennes and Comanches. These foes dwelt near a great lake in a sandy region (ⅅi-za′-ba-he-he′) near the head of the Elkhorn river, Neb. At this time the combatants used wooden darts instead of bows and arrows. The writer was at the old Ponka reservation, Todd county, Neb., from May, 1871, to Aug., 1873. During this period he often visited the remains of an ancient Ponka fort not more than a quarter of a mile from his house. A rough diagram of this fort is given.

After the Iowas and Omahas went south the Ponkas claimed all the northern part of Nebraska, along the Missouri river, as far as what is now Dakota county, where began the Omaha territory.

The Ponkas say that they had seven "old men" since they became a separate tribe. Under the fifth "old man" they first saw the pale-faces. They are now under the seventh "old man."

MAP 4.



Map showing the Ponka fort.

The Omahas, according to some men of their tribe, are now under their fifth "old man." Among the Dakotas, according to some anthorities, an "old man" denotes a cycle of seventy years

or more. If the Ponkas use the term in this sense, and are correct in so doing, they may have had a tribal existence for about 490 or 500 years. This would extend back as far as A. D. 1390 or 1380. (It was told the writer in 1880.) Let us see how this agrees with the reports of early writers taken in connection with the period required for the migrations which have been described. We must remember that in those days firearms were unknown, and that therefore the destruction of game was not as rapid as it now is; that horses could not be had, rendering locomotion very slow; that removals from permanent villages (such removals depending on the destruction and departure of game) need not have been at very short intervals, especially when the construction of of such villages was a work of great labor, owing to the primitive character of the tools employed, and has a religious significance, being accompanied with sundry mystic rites, some of which are still preserved among the Osages and Kansas.

The director of the Bureau of Ethnology found a tradition among some of the civilized tribes in the Indian Territory, refering to the ancestors of the Kwapas, etc., which agrees with what has been said, *i. e.*, that they dwelt east of the Mississippi prior to A. D. 1700. In 1673 Marquette had heard of the Maha (Omahas), Pana (Ponkas?), Pahoutet (Iowas, Paqotce) and Otontantas (Otos), as inhabiting the country on the right bank of the Missouri river. The separation of the Iowas, Omahas and Ponkas, and therefore all previous migrations, must have occurred before 1673. Furthermore, the separation of the Kwapas from the others, and the taking of these correlative names, Kwapa and Omaha, must have occurred prior to A. D. 1540, as De Soto met the Kwapas in that year.

Even at the present day, when horses have been available, the Omahas have remained in a permanent village for ten years at a time, and have returned repeatedly to such an old village. We have no recorded tradition of similar returns to favorite villages in prehistoric times, yet such returns may have occurred, and if known would tend to increase the duration of the period between the meeting of the white men and the time when the Indians in question were east of the Mississippi river.

THE TORTURE OF THE FISH-HAWK.

BY I. LANCASTER.

WHILE engaged in the task of explaining the mystery of the flight of soaring birds on the shores of the Gulf of Mexico, where many species abounded, unusual and astonishing performances were witnessed on the part of these inhabitants of the air.

The month of March revealed more of these out-of-the-way feats than other times of the year, and as the breeding season occurred in this month, especially on those remote keys and interminable flats constituting the peninsula of Southern Florida, it was fair to presume that feelings growing out of the relations of the sexes prompted the remarkable behavior.

Were it not absurd to transfer to external nature those moral emotions generated in the mind from the primordial impressions of pleasure and pain, one would be tempted to assert a radical diabolism in the scheme of things on witnessing the seeming fiendishness of some of these creatures having dominion of the air. Nothing but a free application of the doctrine of the transmission of qualities through inheritance, coupled with variations amounting to divergence, as the line descends, can dispose of deliberately evil intention somewhere, or of a natural process, the outcome of which is bad. No inference from the hooked beak and grasping talons of the carnivorous birds gives a clue to the origin and development of a disposition on their part to inflict pain for the mere sake of the torture. Those structures find their function in the legitimate life struggle, but the infliction of needless pain, in no way connected with that conflict, seems to be imposed from another source.

The distribution of land and water on the Gulf coast of Florida is favorable to the existence of fish. The interminable flats, bare, or covered with a thin sheet of water at low tide, and traversed by many winding channels, give the smaller kinds refuge from the rapacity of the larger, and furnish breeding grounds without stint. The many tidal creeks, often a succession of deep holes connected by mere rivulets, through which the tide sluggishly ebbs and flows, also give security for the deposit of eggs and growth of young. The gulf is also a vast caldron of warm water, prolific through its whole extent in monsters of the deep, many of which, such as sharks and porpoises, penetrate the passes

between the keys and entering the channels of the bays play havoc with the lesser tribes. These are devoured in great quantities, and the killed and wounded which escape the maw of their fierce enemy can be seen stranded on the flats at low tide.

All this teeming life goes on in a climate of surpassing loveliness. Frost is a rarity; ice unknown; day succeeding day of delightful blandness. Extreme heat is not experienced, and storms worthy of the name very rare. The soil of the lower peninsula is pure sand as sterile as Sahara. The vegetation is prolific in air plants, semi-tropical bushes and stunted growths, and a perpetual verdure is everywhere. But there is nothing in it all that a man can live on, and hence the population is limited to the sporadic migrations of excursionists and invalids, and a few "crackers," always hungry, and seeking something capable of being devoured.

This combination of circumstances forms a splendid environment for such birds as can in any way subsist on a fish diet, and what might be expectcd is what is found. Birds with legs long enough to wade on the flats; those which have inherited the expertness of a swimming-school adept and can dive with ability, and those which can subsist on the carcases of unfortunates, have here everything pretty much to suit them. Long lines of pelicans can be seen on every hand, with that grandmotherly air of supreme contentment arising from a continuously satisfactory cuisine. Cranes of all lengths of legs and necks, stalk about, hastily gobbling their prey. The carrion-eating vultures are always present enjoying the incoming breeze by resting in it on motionless wings, or wheeling about on the lookout for subsistence.

But the birds which particularly interest us are the fish-hawks, also dependent, like the others, on the life found in the tepid waters. These birds are arboreal in their habits, nesting in the tops of the pine trees and rarely resting on the ground. They fish for the most part in the creeks and secluded inlets, hovering over the waters and suddenly capturing their victim by diving upon it. But they sometimes come over the open waters of the bays, and when the keys are covered with trees, over the gulf, to find their food. On first acquaintance their actions seemed inexplicable. I could not account for their eccentric ways. While in the hidden places of the creeks they utter no cry, and seem to be efficient masters of the craft, but in the open they vacillate painfully.

They are large, active-winged birds, never soaring, are quite strong, and weigh about six or seven pounds. On leaving the trees lining the shore, perhaps allured by a school of mullet in the channel, they seem eager for action, and all alive with expectation, but just before stooping on the fish would set up a frightened, discordant scream, and make for the shore with a haste so ill-advised as seriously to impede progress. Before the trees were reached, confidence would be restored, and returning, the same singular performance would be repeated, perhaps for three or four times before the game was finally secured. No enemy was in sight. The breeze would flow gently. All was serene, yet terror would take possession of the bird and almost paralyze its efforts by making it frantic. I soon learned the reason for this cowardice. Stretched at length on the deck of a boat in the early morning in the pass of Boca Grande, one of the entrances to Charlottes harbor, I saw a fine specimen of hawk cross overhead and proceed seaward to find a dinner. The excursion was successful as the pass swarmed with fish coming in with the tide. A fine one soon left its element and swung aloft into the air in the talons of the bird, which at once began its return. But a new-comer appeared upon the scene. A black creature which seemed all wings and shaped like a flattened letter M, dropped from above and confronted the hawk, which at once dropped its prey and uttered a scream so brimful of mortal terror that it should have excited the sympathy of all living things within the compass of its sound. It was not disturbed by actual contact. The two birds were not within fifty feet of each other, but the hawk exerted itself with the same wild energy to get to cover which I had before so often witnessed when no black monster was in the vicinage. The intruder was a frigate-bird, and on looking upwards a score of them could be seen a mile or more from the earth, floating round and round, on motionless wings. The dropped fish was seized in the beak of the bird long before it reached the water, and with a sweep of exquisite grace, on tense wings, fronting a mild breeze, the corsair was lifted half a mile into the air, where another astonishing performance was at once initiated. A bite was taken from the body, being torn away by a wringing motion of the head which sent the carcass whirling, while the bird masticated the morsel in shape for swallowing. Of course the fish began to obey the law of falling bodies, and the bird, folding its wings

tightly upon its body, dropped swiftly after it. The part bitten off being disposed of, another swoop downwards was made, the fish seized, and the upward swing repeated, and this process continued until the entire carcass was devoured.

At the time of this visit these frigate-birds were oblivious of man's presence and I was so fortunate as to secure this one by a well directed shot. It measured eleven feet in alar dimensions and weighed eight pounds. Its feet and legs were ridiculously small and weak, and viewed as weapons of offense and defense could not compare with the talons of the hawk it had robbed and terrified. Its head and beak were strong and well developed, but by no means superior to those of the other. The terror which inspired the hawk was still unaccounted for. In a contest for superiority on the ground of physical strength and effectiveness of weapons it would have been victorious. The whole case was still enveloped in mystery.

Returning to this locality after the absence of some weeks I found the black outlines of the frigate-birds against the sky as usual, and soon saw the inevitable hawk over the waters of the pass all excitement at the prospect of a dinner. It was the beginning of March, and in that month the sea-breezes of the vicinity are particularly delightful. It is also the breeding season of the birds when their plumage is at its best, and they show to best advantage. Success always followed any well directed effort of a bird to catch a fish in Boca Grande pass, and the hawk soon had one. A black corsair at once appeared and captured the booty as on the former occasion, while the frightened fisher fled screaming towards the land. But now a change of programme took place. Another long winged creature from the group above appeared in front of and facing the frightened hawk which turned seaward at once, mingling its note of terror with one of despair. Every effort to side off towards home was frustrated by the gliding terror interposing its bulk in the intended direction, until the victim seemed to accept the inevitable and made an attempt to cross the gulf. The tormenting enemy then seemed content, and swung aloft among its companions. The poor fisherman, rid of the dire presence, wheeled on its course for home, and its frenzied flappings relieved of excessive tension, made very good time, when on reaching the very brink of safety the black wings again appeared and the whole distressing business was re-enacted with

The Frigate Bird.

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increasing despair in the frightened cry. This went on for more than half an hour. Every effort at retreat was intercepted. During all the time the hawk kept up an incessant flapping of its wings, and its physical endurance was giving way under the protracted strain. This was apparent from the changing tone of its scream, which varied through all the gamut of despair, from unreasoning terror, to supplicating misery. It was the Roman gladiator's "Cæsar, the dying salute thee," with the ambition left out.

The frigate-bird at length seemed impatient. It more promptly answered the movements of the hawk, and urged compliance with greater vigor, and finally introduced a new feature into the proceedings. Swooping upwards for one hundred feet it turned head foremost, and plunged beneath the hawk, turning completely over as it did so, and passing to the front vaulted upwards, and down again in the same path, thus describing an elliptical orbit around its victim. It swung near the hawk round the lower curve, causing upward flight, until at length in an exhausted condition it was introduced into the company of its tormenters which had been descending from high levels and were now about four hundred yards above the water. Its strength was now well nigh exhausted. Its cry was scarcely audible, and it barely had the power of directing its movements. In whichever way it went, excepting one, a black terror confronted it. It could rise unimpeded, but found resistance to every other course. It struggled upwards for some four hundred yards further, until the distance was so great as to make it difficult to keep the movements in the field of the glass, when it gave up the task, and rapidly floundered over and over through the air, its muscular power exhausted, and its mass surrendered to the gravitating force. Down it came, the whole half-score of enemies circling about it, until it struck the water near the beach in the shallows of the offing. The tide was running out and the water on the flat not over a foot in depth.

Supposing the play to be out I was proceeding to examine the victim when it was evident that more was to come. The hawk was not dead and would at intervals raise its head from beneath the water to breathe. It had not strength to submerge its body, and with the vital air came a vision of the hovering terror. Down went its head with a gurgling murmur, and those black demons would alight upon it with their miserable puny feet and push it entirely beneath the surface.

The vitality of the fish-hawk is something wonderful, for this pastime went on for an hour, until at length it was completely dead. The body floated to shallow parts in the ebbing tide and rested stationary on the bottom, when each bird in turn alighted upon it, folded its wings, and rested in perfect quiet for five minutes, when it would rise in the air and a comrade take its turn. The appearance of these creatures, while thus employed, was that of quietly expecting something which did not happen. I had approached to within thirty feet of the dead hawk, but not the least attention was given to my presence. The birds always alighted with their heads towards the head of the carcass, and stood out their time, without making a movement, in a slightly crouching attitude, as if to be prepared for what would take place. This curious performance lasted for an hour, when, moved by a single impulse, they stretched their long pinions and went aloft, where they could be seen in their interminable circling flight, round and round, and the tragedy was ended.

The sun was low in the west; the tide had ceased to flow; the breeze had died away, and everything was tranquil. All nature seemed to overflow with love and peace, and yet an awful scene had filled those quiet hours. I felt myself in the grasp of something infernal. It was as if the guest of Solomon had been confronted in the garden, in every avenue of escape, by awful death, until he had surrendered life after exhausting all the forces of his nature to escape his doom. An examination of the carcass revealed no wounds. It was a case of suicide entirely. But what a dreadful motive to commit the deed.

Through all this tragedy the wings of the frigate-birds were motionless, excepting when they were engaged near the water. To rise or fall was indifferent to them. When confronting the hawks, the contrasted wing-motions of the two birds was conspicuous—one was beating the air rapidly, the other not at all. Though afterwards explained, this ability to counteract air resistance and weight without muscular exertion was then as great a riddle as any other part of the work.

I remained in that locality for a month, but witnessed no repetition of this day's tragedy. The frigate-birds occupied the air and the hawks fished in the pass undisturbed, or if their prey was stolen, they were allowed to escape; but on returning a year afterwards, I witnessed an analogous scene, after waiting for weeks

for the event to occur. A hawk, quite differently marked and much larger than those usually seen, crossed from the opposite key and struck a fish from the passing school, which was promptly seized by the waiting frigate-bird. The hawk fled in terror, as usual, and was confronted by another of the band and, on examing the sky, still another, three in all, was seen. After the confronted hawk had turned, it seemed to lose its terror, its cry denoting submission, a sort of querulous surrender to the inevitable. To my surprise, it resumed its fishing, while the rover retired. It soon secured another from the teeming waters, for all it had to do was to pick it up. This was captured and the screaming retreat once more arrested. A simple hint was quite enough. The slave returned to its task with many an unnoticed murmur, until each bandit had secured a feast. The hawk then escaped hungry, and disappeared from sight.

After witnessing this way of getting a living, a black garment seemed lifted from nature. The method was so like that practiced by man, as shown in history, that it quite contented me. These frigate-birds are the banditti of the air. During a residence of five years on that coast, I never saw one get an honest living. They seem to be the especial favorites of nature, as the cosmical force of gravity is placed at their disposal, which is a little like giving them the lamp of Aladdin. Small use would it be for a creature required to provide its own motive power to sustain itself in air, and also that required to fight a battle for life, to oppose such odds. The relation to success such combatants would stand in would be almost infinity to one.

A familiar sight along that coast, at all seasons of the year, is that of gulls riding on the backs and heads of pelicans and feeding on the fish from their gullets. There is a good understanding between these creatures, and I never saw them quarrel. Sometimes when fish were scarce and the small intruders wanted all, a contest as to which could swallow the most in the shortest time took place, to the usual discomfiture of the little ones, who never seemed to understand how nor why the food disappeared. This scheme of subsistence-supply gave the missing link needed to acquit nature of deliberately plotting the torture of her creatures. Away back in the great secondary age, when reptiles navigated the air on wings, the characteristics of a frigate-bird may have been initiated. In the life-struggle, habits of the gull

were acquired which led the creature, *then* neither frigate-bird nor gull, to get its food by association with some messmate more able to procure it. Then these two forms diverged from the common ancestor, acquiring new traits from new environments. As the frigate-birds gained dominion of the air, they also gained dominion of species of fish-hawks, which became enslaved by them. But the hawks also diverged into other species, one or more of which retained the terror, but not the discipline, and, when commanded, would not comply, through sheer ignorance of the nature of the demand. When the birds met with a specimen of this branched stock, they urged obedience with such vigor as to result in the death of their unfortunate victim. Then the old ancestral habit, which may be had outlived a thousand generations, comes into play, and they stand on the dead body, in pure friendship, waiting to be fed! What do they know of the mystery of death? The only weak place is where the branching hawk forgot the duty of fishing for its master, but not the terror of its presence. But then fear is what prompts it to escape from an enemy and thereby save its life, so that this emotion would properly survive the other.

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A STUDY OF GARDEN LETTUCE.

BY E. L. STURTEVANT, M.D.

AT the New York Agricultural Experiment station, in 1885, eighty-three distinct varieties of lettuce were grown under nearly two hundred names. These lettuces present to the onlooker three distinct form-species, the lanceolate-leaved, the Cos and the cabbage. It is a pertinent inquiry as to whether these form-species are of distinct origin or have been produced by cultivation within recent times, and we hence offer a succinct account of our historical investigations.

The lanceolate-leaved form is represented with us by one variety only, the deer's tongue, introduced as a seedsman's novelty in 1883. The type of this form is perhaps referred to by Pliny, lib. XIX, c. 38, "præterea longi et angusti intubi similis," as this plant of ours has a chiccory-like appearance in some stages of its growth. It is certainly mentioned by Bauhin[1] in 1621, and credited in his synonomy to Castor, 1585; and is figured by Bauhin[2]

[1] Pinax, ed. of 1621.

[2] Prodromos, ed. of 1671.

in 1671. Vilmorin,[1] 1883, refers to this type of lettuce under the name *Romaine asperge, Lactuca angustana* Hort., and a variety *L. cracoviensis* Hort. *L. angustana* Allionii, 1785, seems to be of this form-species, and is recorded as found wild in Switzerland, and Martyn's Millers Dictionary deems the *Chicoreum constantinopolitanum* of Parkinson, 1640, to have some affinity to it.

The Cos lettuces are distinguished by the upright growth of the root leaves and the elongated and spatulate form of the leaf; they are also subject to a flattening of the stalk through fasciation. They were perhaps known to the ancient Romans, as witness Pliny's[2] statement: "Diligentiores plura genera faciunt: purpurea crispas, Cappedocas, Græcos. Longioris has folii, caulisque lati; præterea longi et angusti, intubi similis." Palladius'[3] mention of the process of blanching can be also quoted: "Candidæ fieri putantur, si fluminis arena vel litoris frequentur spargatur in medias, and collectis ipsæ foliis alligentur." The Cos lettuce is the Lactuca Romana dulcior, nigriore and Scariole hortensis folio, semine nigro of Pena and Lobel,[4] 1570. Bauhin in his Pinax considers this form to be the L. foliio obscurius virentibus nigra Plinio of Dodænus,[5] the *L. nigra* of Cæsalpinus, 1583, and the *L. romana* of Castor Durantes, 1585. In the sixteenth century the Cos form seems to have been less grown in Northern Europe than in the south, for Pena and Lobel[6] say it is rarely cultivated in France and Germany, more frequently in Italy, especially at Rome. It reached France in 1537.[7]

The class of cabbage lettuces are distinguished by the rounded and spatulate leaf which grows less upright than the Cos. Although the commentators of the sixteenth and seventeenth centuries deem this class to have been known to the ancient Greeks and Romans, and identify it with the Laconicon of Pliny and the Tartesian or Bætica of Columella, yet I am unable to find any certain evidence. The only word I find in Pliny which could suggest this class is "crispa," which may be translated "wrinkled," and as a class the cabbage lettuces are more wrinkled or

[1] Les Plantes Potageres.
[2] Nat. Hist., lib. XIX, c. 38.
[3] De Re Rustica, lib. II, c. 14.
[4] Stirpium Adversaria Nova, Londini, 1570, p. 90.
[5] Pemptades, 1621, p. 644.
[6] Loc. cit.
[7] *Heuze. Lesve. Alim. i, p. v.*

blistered than are the Cos. Columella was a native of Gades, but resided principally at Rome. He[1] speaks of two kinds which may belong to this class, one the Cappadocean "Tertia, quæ spisso, sed puro vertice pallet," and "quæ pallido and pexo densoque folio viret;" the other the Tartesian or Bætica, which he says is from his country:

> "Et mæ, quam generant Tartesi litore Gades
> Candida vibrato discrimine, candida thyrso est,"

and "quæ deinde candida est and crispissimi folii, ut in provincia Bætica and finibus Gaditani municippii." The words "vibrato discrimine" and "crispissimi folii" would imply a curled cutting lettuce. The heading lettuces of this class were, however, well known to the writers of the sixteenth and seventeenth centuries. Anton Pinaeus,[2] 1561, figures one which closely resembles the stone tennis ball variety of our gardens, and Bauhin in his synonymy identifies with varieties described by Tragus, 1553, Tabernæmontanus 1588, Matthiolus 1586, Gerarde 1597, etc., etc.

Whether the types of the Cos and the cabbage form-species occur in nature, I have not the material for study to determine. De Candolle[3] says "botanists are agreed in considering the cultivated lettuce as a modification of the wild species called *Lactuca scariola.* The latter grows in temperate and Southern Europe, in the Canary isles, Madeira, Algeria, Abyssinia and in the temperate regions of Eastern Asia. Boissier speaks of specimens from Arabia Petrea to Mesopotamia and the Caucasus. He mentions a variety with crinkled[4] leaves, similar, therefore, to some of our garden lettuces, which the traveler Hausknecht brought with him from the mountains of Kurdistan. I have a specimen from Siberia, found near the River Irtysch, and it is now known with certainty that the species grows in the north of India, in Kashmir and in Nepal." From this reference we might infer that the Kurdistan form belonged to the cabbage type, as possessing distinctly wrinkled or savoy-like leaves, while the description of the ordinary *L. scariola* of Europe implies the Cos type.

I have not opportunity of access to herbariums whereby I can hope to satisfy myself of the condition of the wild forms from

[1] De Re Rustica, x, l. 183; xi, c. 3; x, l. 185.

[2] Hist. Plants, 1561.

[3] Origin of Cultivated Plants, 1885, p. 95.

[4] The word in the original French edition, p. 76, is *crispee*, which should rather be translated wrinkled or bullate.

various countries, but such evidence as I have here outlined strongly supports the hypothesis that our three form-species of lettuce have originated from wild forms which have been brought into culture in different regions, and hence that our three form-species have different origin. The history of lettuce as published affords no clue towards settling this point. Lettuces are supposed to have been grown by the Persians some five hundred years before Christ, and to have been introduced into China between the years 600 and 900 of our era; they were mentioned by Chaucer in England in the fourteenth century, and reached America with Columbus.

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AQUATIC RESPIRATION IN SOFT-SHELLED TURTLES: A CONTRIBUTION TO THE PHYSIOLOGY OF RESPIRATION IN VERTEBRATES.[1]

BY SIMON H. AND SUSANNA PHELPS GAGE.

IT was formerly supposed that in all reptiles the respiration was exclusively aërial at all periods of their life, and that the lungs were the only respiratory organs. We have demonstrated, however, that in soft-shelled turtles (*Amyda mutica* and *Aspidonectes spirifer*) there is in addition a true aquatic respiration. This is *indicated* by three facts: (*a*) These turtles remain most of the time in water, and voluntarily remain entirely under from two to ten consecutive hours; (*b*) while under water they fill and empty the mouth and pharnyx, about sixteen times per minute, by movements of the hyoid apparatus, the general appearance being like the respiratory movements of a fish; (*c*) the mucous membrane of the pharynx is closely beset with filamentous processes, appearing like the villi of the small intestine of a mammal or the gill filaments of Necturus. These processes are especially numerous along the hyoid arches and around the glottis, and are copiously supplied with blood.[2]

[1] A preliminary paper upon the respiration of Aspidonectes was presented to the A. A. A. S. by the senior author in 1883, and printed on p. 316 of the Proceedings (Vol. XXXII).

[2] So far as we know but two original observations (besides that mentioned in the preceding foot-note) have been previously made upon the Trionychidæ bearing upon the subject of this paper: (*a*) In February, 1856, Dr. A. Sager called attention to the processes in the pharynx of Aspidonectes, and compared them, in appearance, with the gill filaments of Necturus and the inner gills of tadpoles. (*b*) Professor L.

But neither the time the turtles remain under water, the filling and emptying of the mouth and pharynx with water, nor even the structure of the parts, proves that aquatic respiration occurs. Final proof of this is only obtained by comparing the free gases found in water with those found in water from the same source after a turtle had been submerged in it without access to air. Water so tested showed in one case that a turtle weighing one kilogram in ten hours removed from the water seventy-one milligrams of free oxygen and added to it 318 milligrams of carbon dioxide. Several other determinations were of the same conclusive character.[1]

This indicates a respiration for the same body weight of about one twentieth of that occurring in man.

As indicated by the figures given above, the carbon dioxide is greatly in excess of what could be accounted for by the free oxygen taken from the water. There are two sources from which the extra oxygen might be derived: (*a*) From the so-called intra-

Agassiz, in Part II of the Contribution to North American Zoölogy, p. 284, says: "Before reading this paper [Dr. Sager's] we had noticed these organs [processes in the pharynx]; but after seeing this turtle [Aspidonectes] remaining under water for full half an hour without showing the least sign of oppression, it seems plausible to assume that these fringes may be similar to the internal gills of tadpoles, not only in their shape but also in their function. There exists, moreover, an extensive network of beautiful vessels spreading in elegant dendritic ramifications upon the whole lower surface of the Trionycidæ which can hardly have another function than that of assisting in the process of breathing, as they are too numerous and too large to be considered simply as nutritive vessels of the skin. This is the more probable as these vessels are very superficial and are only covered by a very thin epidermis. They are indeed as plainly visible through the horny layer which protects them as the vessels of any special external breathing organ." * * *

[1] The following table shows the results of three analyses. In the first column is given the total amount of free oxygen taken from the water (ten liters) in ten hours by a turtle weighing one kilogram. The second column contains the quantity of carbon dioxide that could be formed from this oxygen; and the third column contains the actual amount of carbon dioxide added to the water by the turtle, the excess of which, over the amount that could be formed from the oxygen taken from the water, is given in the fourth column:

	O.	CO_2.	*Actual* CO_2.	*Excess* CO_2.
July 11.....	71 mg.	97 5-8 mg.	231 mg.	133 3-8 mg.
Aug. 8.....	32 "	44 "	212.7 "	168.7 "
Aug. 9.....	39 "	53 5-8 "	168.7 "	115 3-40 "

The determinations were made with the greatest care and accuracy by Professors Rich and Holton in the chemical laboratory of Cornell University.

molecular oxygen stored up in the tissues, and (*b*) from the air in the lungs. Analysis of the air taken from the lungs after the turtle had been wholly submerged for ten hours, showed only a slight trace of either oxygen or carbon dioxide. So far as this single experiment goes, we conclude that if the lungs were moderately filled with air upon the immersion of the turtle, the amount of oxygen that might be taken from the air in the lungs would fully account for the excess of carbon dioxide found in the water. That the aquatic respiration is due almost entirely to the pharynx and but slightly to the skin, is shown: (*a*) By anæsthetization, the turtle becoming anæsthetized four or five times as quickly when kept entirely submerged in ætherized water as when allowed to come to the surface as frequently as it desired. (*b*) When the turtle's skin was completely covered with vaseline and the turtle kept wholly submerged, the amount of oxygen removed from the water and of carbon dioxide added thereto was nearly as great as when the skin was unvaselined.

In some at least of the hard-shelled turtles (Chelydra and Chrysemys) similar movements of the hyoid apparatus occur when they are submerged, and water is seen to enter the nostril and be expelled therefrom as in soft-shelled turtles.

The pharynx expands and contracts with considerable regularity in all of the turtles, so far as we know, when they are in the air. These movements appear like those of the frog, but in the turtles they are unnecessary for filling the lungs. In frogs, however, they are necessary for this purpose, although as shown by Townson (1794), pharyngeal movements often occur in the frog without any air being forced into the lungs.

As these movements are of undoubted use in respiration for the soft-shelled turtles in water, it seems probable that they may be of use in respiration for all turtles in the air, that is, the membrane lining the pharynx probably acts as a respiratory organ whether the medium bathing it and containing free oxygen be air or water.

These movements and their object, respiration, then seem to connect, physiologically at least, the turtles on the one hand with the lower vertebrates—Amphibia and fishes—and on the other hand with the higher forms, viz., dog and man, for Garland has shown that in the dog, and also in man, occur rhythmical pharyngeal movements which draw air into the pharynx and expel it

whenever there is a condition approaching asphyxiation. It seems as though these pharyngeal movements reappear in the highest forms when the want of oxygen becomes overwhelmingly great, as if there were an organic memory of the means by which, in the dim past, the want was supplied.

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DESCRIPTION OF A NEW SUBSPECIES OF THE COMMON EASTERN CHIPMUNK.

BY C. HART MERRIAM, M.D.

THE common chipmunk or striped squirrel of Eastern North America was first mentioned, so far as I have been able to ascertain, by Sagard-Théodat in his Histoire du Canada ("Vol. v, p. 746"), published in 1615. In 1743 Mark Catesby gave an unmistakable description of it, accompanied by a recognizable colored plate.[1] He called it *Sciurus striatus*, which name was adopted by Linnæus in the tenth edition of his Systema Naturæ, published in 1758. The specific name *striatus*, after enduring the vicissitudes to which scientific nomenclature is so often subject,[2] was reëstablished by Baird in 1857, and has since enjoyed undisputed recognition on this side of the Atlantic.

It is a little singular that thus far no one seems to have suspected the existence of two distinct subspecies of chipmunk in Eastern North America, particularly when it is remembered that no less than five geographical races of the Western species have long been recognized.

It is true that Professor Baird, nearly thirty years ago, stated that a chipmunk from Essex county, in Northeastern New York,

[1] "SCIURUS STRIATUS. *The Ground Squirrel.* This is about half the Size of an English Squirrel, and almost of the same Colour, except that a Pair of black Lists, with a yellowish white List between them, extend almost the Length of the Body on both Sides; also a single black List runs along the Ridge of the Back. The Eyes are black and large, the Ears rounding, the Tail long, flat, and thick set with Hairs, which are much shorter than those of other Squirrels. These Squirrels abide in the Woods of *Carolina*, *Virginia*, &c. Their Food is Nuts, Acorns, and such like as other Squirrels feed on. They being brought up tame, are very familiar and active." (Natural Hist. of Carolina, etc., by Mark Catesby, Vol. II, 1743, p. 75).

[2] For more than half a century our animal was confused with the Asiatic, but it is not the purpose of the present paper to enter into a discussion of the complicated synonymy of these species, already very fully elaborated by Allen. (Monographs of North American Rodentia, 1877.)

"is considerably grayer, and the black lines of the back have no brownish margin. In a specimen from Washington [D. C.], the chestnut tints are darker than described above" (North American Mammals, 1857, 294). But his material was not sufficiently extensive to enable him to appreciate the constancy and significance of the differences noted.

Allen, in his most valuable paper on Geographical variation in color in North American squirrels, said: "The increase in intensity of color from the north southward" is well illustrated in "*Tamias striatus*, representatives of which from the southern parts of New York and Pennsylvania are much more highly colored than are those from Northern New England and the British Provinces" (Proc. Bost. Soc. Nat. Hist., XVI, 1874,4). Later, however, the views above expressed seem to have undergone some modification, for the same author observes: "The very large number of specimens before me indicate that the present species preserves great constancy of coloration. * * * Specimens from Southern localities are considerably brighter colored than those from more Northern sections, and average a little smaller. The difference, however, in either respect, is not very great" (Monographs of North American Rodentia, 1877, 784–785).

The examination of more than two hundred specimens has led me to differ with Mr. Allen in his last expressed views. His remarks concerning the deepening of color southward might have been stated more strongly, and still fall within the limits of truth.[1] In respect to size, if the body as a whole was meant, my measurements of upwards of one hundred specimens in the flesh do not show the Southern animal to be the smaller, and the largest individual that has fallen under my notice came from Monticello, Mississippi. If, however, we turn to the extremities, the case is different, for the length of both fore and hind feet is greater in northern than in southern specimens, as shown in the accompanying tables:

[1] Mr. Allen's views, as above enunciated, were based upon the examination of upwards of one hundred and fifty specimens; still, it is but fair to state that the great majority of these specimens came from Northern localities, and were either typical of the Northern form or intermediate between it and the Southern. He had but four skins from so far south as Washington, D. C., and had not seen a single individual from the Carolinas.

MEASUREMENTS OF FEET, SHOWING DECREASE IN SIZE FROM THE NORTH SOUTHWARD.[1]

Locality.	*Manus.*	*Pes.*	*Condition when measured.*
Locust Grove, New York (average of 28).....	22.11	36.17	In the flesh.
Sing Sing, New York (average of 8).....	21.71	34.77	" "
Washington, D. C. (one specimen)	20	34	" "
Charleston, S. C. (one specimen).....		34	Skin [2]

It must be remembered that the above measurements of New York specimens are averages. The largest manus from the Adirondack region measures 23^{mm}; the largest pes 38^{mm}. The smallest manus from the Lower Hudson measures 20^{mm}; the smallest pes 34.

In the summer of 1884, Dr. A. K. Fisher, at my request, sent me several chipmunks from Sing Sing, New York, in the valley of the Lower Hudson. On placing them alongside my own series from the Adirondack region I was at once struck with the marked differences between them, and was convinced that they were subspecifically separable. This opinion was confirmed the following year by the acquisition of an adult female from the mountains of North Carolina, kindly presented to me by Mr. William Brewster, who killed it in the town of Sylva, Jackson county, North Carolina, May 30, 1885. This individual, for two reasons, may be regarded as the type of *striatus* proper: First, because it came from the same general region from which Catesby's probably came (and it will be remembered that Linnæus's diagnosis was based on Catesby's description and figure); and, second, because it is representative of a phase of pelage most remote from that of the Northern animal. This skin (No. 1450 Mus. C. H. M.) is very much darker than the darkest Washington example I have seen, and the ferruginous of the rump is restricted in extent, and is overcast by the liberal admixture of black-tipped hairs. There is an obscure dark spot at the end of the nose above, and another at the posterior angle of each eye. The eyelids are buff, and the color of the lower lid can be traced backward, though becoming very faint, to the lower margin of

[1] The measurements here given, as well as all others which appear in this paper, were taken by myself with dividers; all were made with the utmost care, and a large proportion were verified by duplicate measuring.

[2] All measurements from skins were taken in the following manner: The feet were dipped in hot water, and then wrapped with wet cotton-wool and left for several hours until the joints became flexible, so that the toes could be straightened readily.

the auditory meatus. There is an indistinct dark line above the light line of the upper eyelid, and a broad, but not well defined, dark stripe below the light under eyelid, extending from a point anterior to the eye to a point just below the posterior base of the ear, where it becomes lost in the grizzled rusty-brown of the sides of the neck. Below this stripe, the side of the face is fulvous. The crown is dark rust-brown intermixed with a large quantity of black hairs, and the same color extends over the anterior half of the inner surfaces of the ears, the posterior half being light fulvous or buff. There is a small, light spot behind the base of each ear. The shoulders and back between the lateral stripes are very dark grizzled iron-gray, with a sprinkling of buff or yellowish. The dark stripes are not perfectly clear black, and their ferruginous borders are not well defined. The median stripe extends from the occiput nearly to the root of the tail. The light stripes are dark buff intermixed with dark-tipped hairs. The sides are buffy-fulvous well sprinkled with black-tipped hairs. The rump, hips, and backs of the hind legs are dark rusty-brown. The upper surfaces of the feet are ferruginous. The upper side of the tail is blackish, edged with hoary; the under side, deep hazel (almost chestnut), bordered with black and edged with hoary. This rich hazel of the under tail extends continuously forward over the anal region to the genitals, where it terminates abruptly without shading off into the surrounding white. The under parts, from the mouth to the genitals, are clear buffy-white.

Through the kindness of Mr. William Brewster, Curator of Mammals and Birds in the Museum of Comparative Zoölogy at Cambridge, Mass., and of Mr. F. W. True, Curator of Mammals in the United States National Museum, I have been enabled to examine the chipmunks contained in these collections. I am indebted also to Mr. William E. Saunders for the loan of a specimen from London, Ontario, Canada. These specimens, together with my own (which in numbers exceed all the others combined), constitute a very complete series of the Eastern animal from the region between Canada on the north and Washington, D. C., on the south.

Comparison of representatives from the extremes of this range brings to light the following differences: The crown in typical Northern specimens varies from pale to bright rusty-fulvous, while in typical Southern examples it is dark rust-brown.

The nape and the back between the median and first lateral black stripes are clear ash-gray in the Northern animal, while in the Southern these parts are dark iron-gray, more or less mixed with grizzly. In specimens from the Mississippi Valley, the same parts show a sprinkling of yellow-tipped hairs.

The light lateral stripes are white, or but faintly tinged with buff in typical Northern specimens, while in typical *striatus* from the South they are strongly washed with buff, which color often deepens to pale fulvous posteriorly, and is further obscured by the admixture of a number of dark-tipped hairs. The sides vary from the palest buff (as in specimen No. 1200) or buffy fulvous in the Northern to dark fulvous in the Southern form. Northern specimens show a slight sprinkling of black-tipped hairs, which increase in number from the north southward till in typical *striatus* the admixture of these hairs very materially darkens the sides of the animal. In typical Northern examples, the pale buff of the sides fades so gradually into the white of the belly that no sharp line can be drawn between them; while in typical *striatus*, on the contrary, a very clear line of demarkation separates the two, the (comparatively) dark sides contrasting strongly with the buffy-white of the under parts, even when these parts are suffused with fulvous—which fact is due to the absence of black-tipped hairs from the belly.

The upper side of the tail is much lighter in Northern specimens than in *striatus* proper, though the hoary edging is more conspicuous in the Southern. This difference in appearance is due to the fact that the black subapical portion of each hair is much broader in the latter than in the former, and the subbasal fulvous portion proportionately narrower. The result is that in the Northern animal the pale fulvous zone shows through, while in the Southern the corresponding zone is mostly concealed by the overlying black. In typical Northern specimens the under side of the tail is buffy or buffy-fulvous, fading in the anal region into the white of the belly; while in typical *striatus* the under side of the tail is deep hazel, which color extends forward around the anus to the genitals, where it ends abruptly without shading off into the surrounding parts.

The dark spot above the tip of the nose is usually indistinct and sometimes wanting in Northern specimens, while as a rule it is well marked in those from the South. The facial markings, on

the other hand, are more distinct in the Northern than in the Southern animal. These markings, however, vary so much in individuals in respect to clearness of definition that they may be dismissed as unimportant in the present connection.

In brief, it may be said that the Northern animal differs from the Southern in the clearness and lightness of its colors, the black stripes remaining much alike in both; or, conversely, that the Southern is characterized by an intensification of all the colors, resulting in the darkening of the entire upper surface.

Richardson, in 1829, seems to have been first to describe the Northern form, though he did not suspect it to differ from the Southern. Believing that the specific name *striatus* belonged to the Asiatic animal, and assuming the American to be distinct, he called the latter "*Sciurus* (*Tamias*) *Lysteri.* (Ray.)," but was wrong in supposing that Ray had named it before him. Baird expressed the matter in a nutshell when he said, "This author [Richardson] quotes Ray as the authority of this name, but it is, in fact, his own—Ray only referring to the species as *Sciurus a Clar. Dom. Lyster observatus*" (North American Mammals, 1857, p. 295).

Richardson's account of the animal he had in view admits of no question as to its exclusive applicability to the present form, and his plate (plate xv), though uncolored, is equally unmistakable. Furthermore, he distinctly states that his specimen came from Penetanguishene, which is on the north-east arm of Lake Huron, a region which, theoretically at least, ought to furnish most typical examples. His description was taken from "a recent male specimen, killed in April at Penetanguishene." The portion of it relating to color runs as follows:

"*Colour.*—The dorsal aspect of the head is covered with yellowish-brown hairs, which are mixed with a smaller number of black ones. There is a black spot near the tip of the nose. The eyelashes are black, the eyelids white; there is a dark-brown streak between the eye and the ear, and a broad, yellowish-brown stripe extends from the nose, under the eye, to behind the ear, deepening in its middle to chestnut-brown. The anterior part of the back is hoary-gray, from a mixture of black and white hairs. The rump, hips and exterior surfaces of the thighs are of a bright orange-brown color, mixed with a few black hairs. A dark dorsal line commences at the occiput, and reaches to within an inch of the tail. This line is brownish at its commencement, but deepens to black posteriorly. There are also, on each flank, two black lines, which commence behind the shoulders, extend to the hips, and are separated by a moderately broad white stripe. All these stripes are more or less bordered with brown. The sides, beneath the stripes, present a mixture of gray and very light brown. The fur, covering the throat, chin, belly, and inner surface of the extremities, is longer and thinner than that on the dorsal aspect, and

is white throughout its whole length. The fur on the upper parts of the body forms a smooth coat, and is blackish-gray at its roots. There is no defined line of separation betwixt the colors of the back and belly." (Fauna Boreali-Americana, Richardson, 1829, pp. 182–183.)

Hence it is clear that Richardson's name *lysteri* must be adopted as the subspecific name of the Northern animal.

Following are diagnoses of the two races:

TAMIAS STRIATUS TYPICUS.—Manus, 20 to 21^{mm}; pes, 34 to 35^{mm}; crown, rusty brown or grizzled brown; nape and back nearly to rump iron gray, sometimes mixed with grizzly; rump, dark ferruginous, sometimes almost chestnut; sides, russet fulvous, passing into ferruginous over the hips, and mixed with a variable quantity of black tipped hairs, the fulvous (losing its black hairs and becoming paler) sometimes encroaching upon the buffy white of belly and occasionally meeting irregularly along the median line below, but always leaving a well-defined line of demarkation between the sides and belly; light lateral stripes strongly suffused with buff and sometimes tinged with fulvous posteriorly; under surface of tail, mesially, dark fulvous to hazel, often very deep.

Habitat.—Valley of the Lower Hudson and Long Island, New York; New Jersey; and southward in the highlands to the Carolinas and Georgia.

TAMIAS STRIATUS LYSTERI (sub-sp. nov.).—Manus, 21.5 to 22.5^{mm}; pes, 36 to 37^{mm}; crown, rusty fulvous, sometimes very pale; nape and back nearly to rump clear ash gray; sides, pale buff, fading into white of belly without leaving any sharp line of demarkation between them; light lateral stripe nearly white, at most but faintly washed with buff; under surface of tail, mesially, pale buff to tawny buff.

Habitat.—Mountains of Pennsylvania; Adirondack region of New York; Northern New England; Eastern Canada north to the Gulf of St. Lawrence, and in the interior north to James's Bay, Hudson's Bay.

Coupled with the foregoing external characters, which serve to separate the Northern from the Southern animal, are certain cranial peculiarities which are equally constant and distinctive. Publication of these differences is deferred until a better series of skulls of the Southern form can be obtained. It may be stated here, however, that the brain case is a little broader in typical *striatus*, while the length of the molar series of teeth is greater in *lysteri*.

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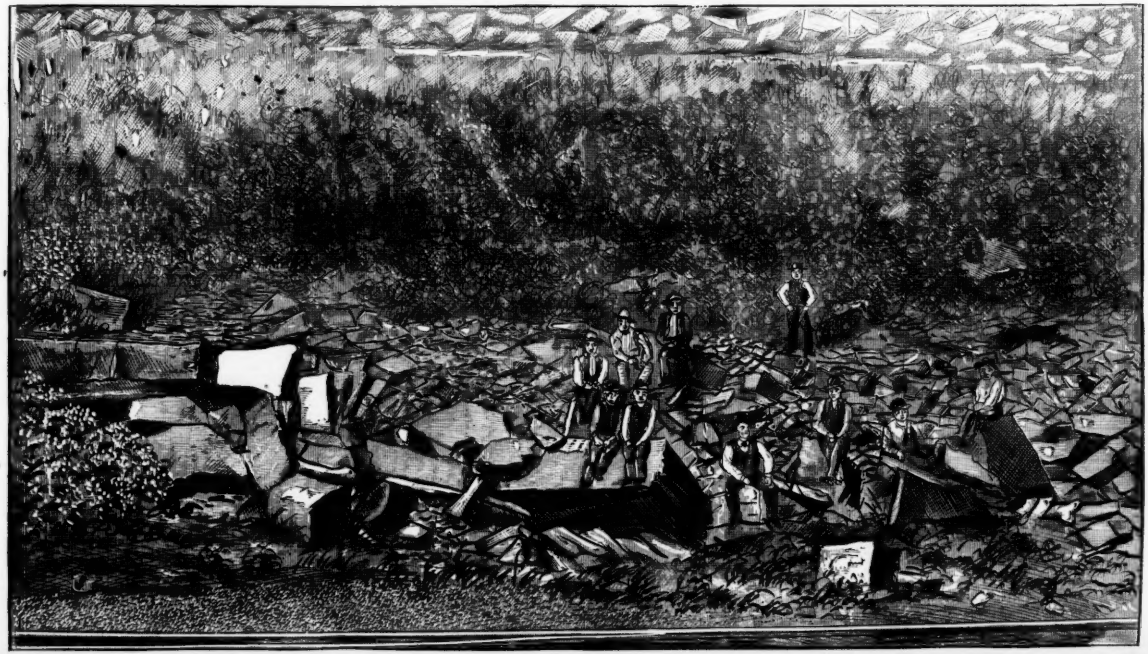


Ledge of Triassic slate and sandstone at Weehawken, N. J., yielding fish remains.

FISH REMAINS AND TRACKS IN THE TRIASSIC ROCKS AT WEEHAWKEN, N. J.

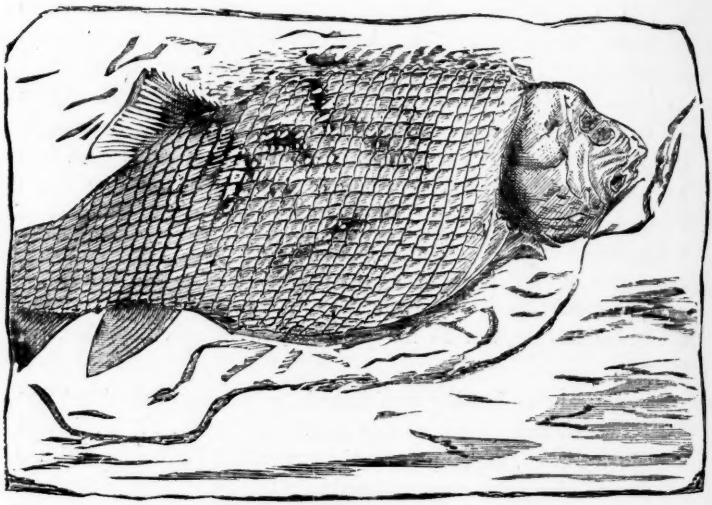
BY L. P. GRATACAP.

THE indurated and fissile shales that crop out beneath the superimposed masses of trap rock along the western bank of the Hudson river at Weehawken, Gottenburg and neighboring localities, have been frequently explored for fish remains. Their unequivocal position as Triassic slates, and the interesting developments made by I. C. Russel at Boonton, N. J., some years ago, in beds of an identical character, stimulated collectors to hunt here for similar fossils. As far as I know there is no published account of any success met with in the search, or indeed an account of any kind. Estheria in compressed and almost obliterated patches have been taken out, but the fish beds kept discouragingly out of sight. Mr. F. Braun, of this city, has recently revealed a large number of fish remains in the slates referred to, and has most successfully extracted specimens of considerable beauty. These specimens comprise almost whole fishes and numerous instructive fragments, while a few plant remains, tracks and ripple-marked blocks from the underlying sandstone have given to his discovery a more comprehensive interest.

In general the locality established by Mr. Braun is about 800 feet south of the mouth of the tunnel of the N. Y., W. S. and Buffalo Railroad, which pierces the trap ridge known as Palisade mountain, a long exposure of basalt limited by Professor Cook as follows: "It may be said to start near the Highlands west of Haverstraw, in Rockland county. The range is continuous to Bergen point. It reappears south of the Kill von Kull on Staten island, and finally disappears near the Fish Kills. Its total length from Ladentown, N. Y., to the Staten Island sound, is fifty-three miles."

Mr. Braun commenced his quarrying in a bed of slates directly underlying the trap rock which rises in perpendicular walls far above it, and found his fish and plant remains restricted to a narrow layer of from three to four inches in thickness, and towards the base of the entire slate bed. An examination of the ledge, of which this bed formed a member, showed a succession of slate,

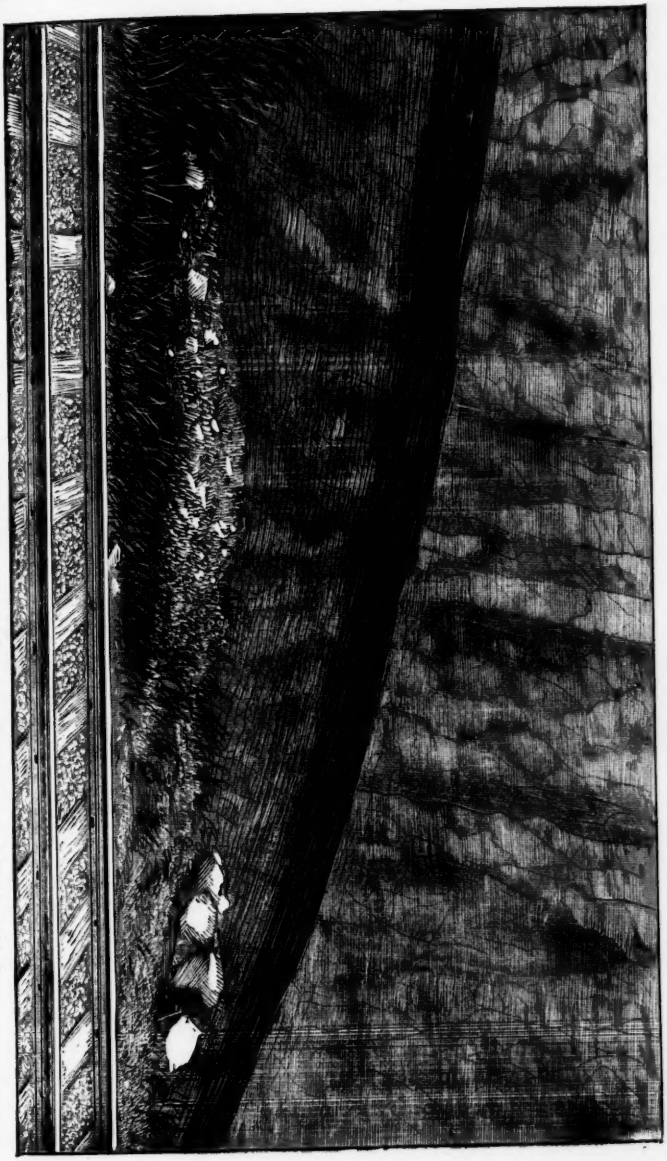
sandstone, slate and trap. At the bottom, forming a low shelf whose base was buried in the alluvium, was a slate group formed of closely compacted laminæ of slate in conformable contact with a bed of sandstone, which at the line of union with the slate was granular and siliceous, becoming compact and feldspathic on its upper side, where it becomes almost fused with a second bed of slate, the fossil layer, above which rose the trap cliff. The exposure of the first slate bed had a thickness of five to six feet, the thickness of the sandstone was four feet, and that of the fossil



Palæoniscus latus Redfd., Weehawken, N. J.

group, as far as could be determined, eight feet, when the base of the trap was reached. The average dip of the series was 17° N. W., and the strike N. N. E. Two photographs were taken, one of the ledge itself (Plate XII), formed of the three beds, and a second at the mouth of the great tunnel, some 800 feet north of this point, where the fossil layer of slate rock with its lines of bedding can be seen conspicuously meeting the trap, fissured by crevices of vertical cleavage (Plate XIII). The first photograph was rather unfortunately invaded by a local group of sitters bearing no sensible relation to its particular object. The standing

PLATE XIII.



Contact line between inclined slate bed bearing fish remains, etc., and trap, at Weehawken, N. J.

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figure at the top marks the fossil layer of slate and the location of Mr. Braun's find.

The fossil remains taken from the slate comprise casts and impressions of plant-roots or root-like fragments, the lobate divisions of an aquatic plant, an enigmatical nut displaying its coaly and black nucleus, and numerous fishes in various stages of preservation, and in positions that seem to throw a light upon the local circumstances of their entombment. Mud cracks reticulate the slate slabs in ramifying lines, the silent witnesses to processes along the shores of an ancient Triassic estuary, identical with those that produce to-day the same markings upon a sun-baked bar.

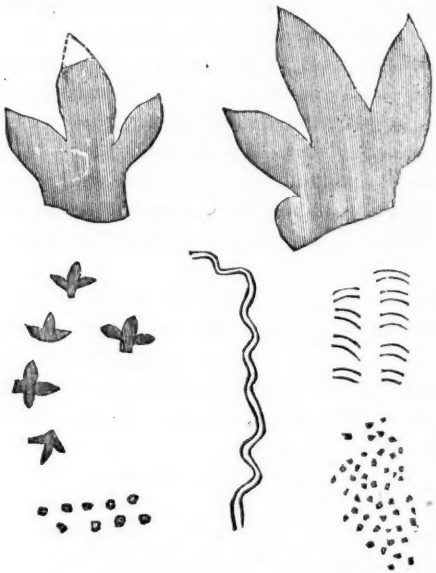
One of the best examples of the fishes in Mr. Braun's collection, now in my possession, is shown in the foregoing sketch.

I think all the fish remains I have are identical with this one as to genus and species, and it appears identical with *Palæoniscus latus* Redfd. On a specimen, other than the one figured, the dorsal fin shows the coarse raylets attached to the anterior spine, and its position, although quite far back, does not correspond to the insertion given for Catopterus. The fishes are found laterally compressed and usually straight, but in some instances the creature has become doubled and turned over on itself as if entrapped while wriggling in its contortions to escape again to the water, which receding left it exposed upon a muddy flat.

Many have become macerated, and the surrounding shale is strewn with their scattered scales, whose disconnected marks gradually become closer in one direction, leading the eye to a formless cluster of scales and head-parts. Most of the specimens suggest that the fishes perished in numbers and were buried beneath later films of detritus as they lay motionless upon their sides. The locality so lately discovered may reveal more of interest both as regards these fish in their zoölogical status, the character of their habitat and the manner of their death. I have found in these slates lenticular masses of a pulverulent and highly carbonaceous material which yielded seven per cent of combustible matter, and would doubtless have reacted for phosphoric acid. They seem connected with the organic occupants of the rocks, and may have arisen through their decomposition.

In the sandstone below this slate Mr. Braun has found impres-

sions, the most striking of which are shown in the wood-cut, suggesting tracks.



Tracks and markings on Triassic sandstone at Weehawken, N. J.

Ripple marks and rain fossæ on other slabs help vividly to recall a shore upon which these ancient waters of the Triassic basin washed, laving the forms of amphibious reptiles or pouring over crawling Crustacea, while showers beat upon the imprinted sands; and on shelving and shallow bars the ripples sculptured their counterparts in gentle furrows.

——:o:——

RESEMBLANCES IN ARTS WIDELY SEPARATED.[1]

BY OTIS T. MASON.

FROM the times of the earliest travelers down to the present day, we have narratives of the occurrence of the same inventions (implements), practices, modes of speech, institutions, theories, and religious creeds and cults in regions wide apart.

The older historians and ethnologists were wont to say that

[1] Read before the Washington Philosophical Society, Jan. 30, 1886.

similarity of human actions argued consanguinity in those who practiced them, that when the same phenomena occurred in two places they must have had their origin from the same race. Those who hold such theories are not all dead, as any one conversant with recent literature well knows. It is quite possible also that among older thinkers there were other ways of accounting for such similarities as I have mentioned.

Before speaking of another explanation it is necessary first to examine more closely the old doctrine. Admitting that all like inventions had their origin from the same race, we have two possible ways by which each one may have been planted in different parts of the world. An art may be so peculiar to a people that its presence argues their presence always, in which case the art may be said to have the same inventor and executor. An art may originate with a race or people, some of whom may carry the knowledge of it everywhere, or foreigners visiting that people may learn the art and carry it home, or it may, undesignedly on the part of any one, be diffused.

In our day of illustrated books and papers there is no telling how far the tuition of culture may extend. In this second case the art has the same inventor, but not necessarily the same executor or disseminator.

Which of these two causes has been active in any case seems to me to be a matter of counting—of numbers. The same race of people would hardly move about over the world, plant themselves here and there, and forget all the occupations and customs of fatherland excepting one or two. Mr. Tylor told the Anthropological Society of Washington that he found in the neighborhood of Philadelphia so much old-fashionedness belonging to England that he could almost imagine himself in the midst of an English village of the last century. On the other hand, the occurrence of a fac-simile of a Grecian temple, as Girard College, in Philadelphia, where other examples of Greek culture are difficult to be found, is an evidence in favor of Hellenic influence, at least upon the architect and trustees of that building.

The other motive to the adoption of the same means for the gratification of human wants or the exercise of human ingenuity, of which previous mention was made, is the identity of those wants and the instrumentalities of their gratification in all branches of the human family, including both the natural apti-

tudes of man himself and the material environment out of which come the resources of gratification. Upon the principle that like causes produce like effects, it is nowadays argued that men will everywhere, under the same *stress* and with the same *resources*, make the same invention. We must carefully note that different grades of civilization and different ages of the world give variable significance to the words *stress* and *resources*. In each age and in each grade, natural, primeval aptitudes are intensified and warped by inheritance and tuition. Material environment is varied and intensified by ever accumulating historical information, refinement and science. Resemblances, therefore, by independent invention become rarer, as the circles of national and racial influence enlarge and cross one another.

Before attemptling to lay down rules by which like human activities may be referred to one or another of the causes just named, the activities themselves ought to be closely scrutinized, in order that we may arrive at an intelligent definition of the word *resemblance*.

Aristotle enumerates four sorts of causes of actions: The material cause, *ex qua aliquid fit;* the formal cause, *per quam;* the efficient cause, *à quâ;* the final cause, *propter quam*. With this classification as a basis we may regard human activities and the things associated with them from several points of view, as one example will shew. The Indian basket-maker there is plying her craft. She is the efficient cause of her art. Under other social organizations it would be the men, and in higher civilization it would be one of a small guild or trade, called the basket-weavers' union.

By her side are strips of grass, splints of root or osier, bundles of cane or rattan, either dyed or in the natural color. These are the material cause of her basket.

She holds in her hand a bone, or ivory, or wooden awl or pricker; it may be also that a knife, rubbing stone and paint-brushes are at her side. These and whatever other tools she uses constitute the instrumental cause of her work.

In her mind are certain forms of baskets and of basket-weaving related to her tribal art and to the structure of the vessel; others also arise spontaneously, and the resultant of them all is the formal cause of the work.

She has her peculiar way of putting her work together, of sit-

ting, of framing, stitching, plaiting, weaving, of placing her material into form for a fixed purpose. These constitute her manner of action, which we may call her processional or methodical cause.

Finally, the foregoing causes have been set in motion with a view to function, to the uses whereunto this basket is to be put—in a word, to the final cause. Moreover, to her art belong a technical vocabulary, all sorts of lore and myths, and even social organization and sometimes religion are influenced by it.

Now, what is true of one occupation is true of another. Each one of them, from the lowest to the highest, involves: 1, agent; 2, material; 3, implement; 4, form; 5, process; 6, motive or function; not to include others unnecessary to mention now.

Again, it must not be forgotten that the materials, implements, forms, etc., of most activities, excepting the rudest, are the products of other activities, and each may have had its six elementary causes, giving rise to generations and genealogies of causes.

Now, let it be especially noted that in each invention or art the resemblance may extend to only one of the six elements, or it may include two or more. Furthermore, resemblance may manifest itself only in some one generation in the genealogy.

If we read carefully the works of those who are constantly pointing out evidences of the migration of tribes or races, we shall see that their attention has been fixed upon only one or two elements of the art under scrutiny.

The complication of causes in producing a result stands in the same relation to the result that complexity of organization does to plants and animals. Those arts that involve the fewest causes, the shortest concatenations of causes, have the greatest chance of arising independently; while those that involve the greatest number of complicated and connected causes give the strongest evidence of absolute identity of origin.

Another consideration which we must not omit in this study is the natural relation between things and their uses; between the number of things which may perform a given function, between the number of functions which a given thing may perform. In human trades, languages, the organizations of society, the fine arts, moralities, the progress of learning, creeds and cults—the bonds of union between the ends to be attained and the number of possible ways of attaining each end vary immensely in

strength and number. Admitted that all human arts whatever start from natural objects, endowments and relations, it follows that in their pristine condition men took the causes of their activity immediately from nature—flint flakes for knives; sharp sticks for spears and spades; gourds and conchs for music; ejaculations for words; consanguinity for social bond; animism for theology, and dreams for revelation. These are so natural and necessary that we need not be astonished to find men flying to them in emergencies and inventing over and over again all the devices and methods of the primeval world. If a stone knife has functions peculiar to itself, if cutting is dependent on stone knives, then the stone knife will often be invented independently. If almost any vocal combination will recall an idea; if almost any vocal combination may stand for innumerable objects, then the possibilities of associating any object with a particular vocal combination will be feebler, and similarities in language in different localities will be more likely to arise from the same people, either by migration or by literary influence. But words fly with such ease and rapidity over the earth that we are in quite as great a dilemma regarding them, whether we shall say that those who use them are of the same blood, or whether in one case they are evidence of tuition.

Since we are thus almost always the sport of three rival theories, I would prefer to adopt a new plan. Laying aside predilections I would adopt the inductive method. There must be a great many resemblances in things from different times and places about which there exists positive information.

Resemblance by independent invention being the least probable, I would scrutinize with great care such examples to ascertain the degree of complexity in the things invented, which we are allowed to suppose. It is my pleasure to bring before the society two inventions about whose independence of origin there can be no question. One is a type of basket-weaving found only at Cape Flattery, in Washington Territory, and on the Congo. The other is the throwing-stick, occurring only in Australia, Brazil and Eskimo land.

The basket weaving may be called the bird-cage type, that is, a series of horizontal rods is crossed either at right angles or diagonally by another series of vertical rods, just like the wires in a bird cage. These rods are firmly lashed in place by a continu-

ous coil of grass or splint, making a diagonal stitch in the front and a vertical stitch in the rear. Now this process is common enough in wattling fences, fish traps, etc., but only in these two areas did men and women hit upon the notion that this stitch would make the most beautiful and effective close weaving. Wherein is the similarity in the two areas? The two forms of weaving stand thus: Alike in method or technique; different in agent (women at Cape Flattery, men on the Congo), in form, material and function.

The throwing-stick is a device for launching a dart or harpoon too heavy for a bow or in situations where a bow would be inconvenient. The Australians have no bows; the Eskimo uses his throwing-stick in the kyak, where a bow would be inconvenient, furthermore his missiles are far too heavy for a bow. Wherein do these inventions resemble? In agent, material, form and function; but not perfectly. In form they agree only in the fundamental invention, a handle and a peg or hook to catch the end of the dart or harpoon. The Australian and the Puru Puru stranded on this, their minds never conceived that it could be altered or improved. The Eskimo, on the other hand, has developed a dozen species of throwing sticks, so distinct that they can be separated by types, as follows:

The Greenland type.....Hooks on the harpoon shaft.
The Ungava type.....Fiddle head at the hook.
The Baffin type.....Broad and clumsy for bird spear.
The Anderson river type..Exceedingly primitive, all in one piece.
The Pt. Barrow type....Amphora-shaped.
The Asiatic type.....Primeval in form.
The Kotzebue type.....Razor-strap form, central index cavity.
The Cape Nome type.....Pegged on the side, rude.
The Norton sound type...Climax of detail.
The Nunivak type.....Finger pegs replace cavities.
The Bristol (variety) .....A variety of Nunivah, but ruder.
The Aleut type.....Flat and wanting in detail.
The Sitkan type .....Elaborately carved.

These types are explained and illustrated in a paper about to appear in the first annual report of the National Museum.

If any one, therefore, questioned the relationship of the peoples now using this weapon, he would be allowed to compare only that of the Asiatic Eskimo, with that of the Australians. If he would regard the genealogies of causes which had led up to the simpler forms in the two regions, there would be no ground left for him to stand upon, and the case of independent invention would be clearly made out.

EDITORS' TABLE.

EDITORS: A. S. PACKARD AND E. D. COPE.

—— The principles which underlie the doctrine of evolution are the unity of organization and the derivation of modern types of beings from a primitive germ. While the theory of descent has rehabilitated philosophy, the leading historians, such as Greene, Freeman and others, have studied and are studying history in the inductive method, and, like the evolutional naturalist or philosopher, or social scientist, go back to the beginning of things historical, detecting, for example, in the early stages of German culture the germs of our democratic system of representation and self-government.

Another set of workmen, the philologists, have long and independently, perhaps, of any influence from naturalists, adopted the methods of the palæontologists and discovered a primitive Aryan prototype of certain of our more modern as well as so-called ancient dialects; and now come the students of the world's alphabets, notably Dr. Taylor and Professor A. H. Sayce, who avowedly confess their inability to work out lasting results without having recourse to modern scientific methods, particularly the doctrine of evolution from a primitive germ.

It appears that the world's alphabets are "all but the manifest developments of a single germ." That germ was the hieroglyphics of Egypt, the running form of which was the selected characters of the Egyptian hieratics. These were adopted by the Phœnicians, who carried them to Greece. The Greek alphabet took its Hellenic shape by the addition of four new characters (φ, χ, ψ and υ), probably, Mr. Sayce claims, derived from the Hittites. Finally a great variety of alphabets belonging to different ages and localities arose, and it was "not until about 400 B. C., when the local dialects began to yield to the 'common' Greek of literary Athens, that the local alphabets also fell into disuse and were superseded by the common 'Ionic' alphabet of twenty-four letters."

Mr. Sayce farther tells us that one of the Greek alphabets, the Euboeic, "was the source of all those which were employed in Italy, * * * * and modern research has now demonstrated, to use the words of Dr. Taylor, 'that all the Italic alphabets were developed on Italian soil out of a single primitive type.'"

Using the identical words of a Darwinian botanist or zoölogist,

Professor Sayce goes on to remark: "In the struggle for existence, the Latin alphabet alone survived among its Italian compeers, and was carried, by the extension of the Roman empire, through the length and breadth of western Europe. Most of our modern European alphabets are its direct offspring."

In Russia and other Slavonic countries the alphabet was of Greek origin, as were the runes of our Norse forefathers.

Professor Sayce even claims that "the immense majority, if not the whole, of the alphabets used in the East are descended, like the alphabets of the West, from the alphabet of Phœnicia. The Hebrew, Arabic and Syriac are derived from the Phœnician, the Syriac being supposed to have been 'the parent of the vertically written Mongolian and Mantchu.'"

"In fact," concludes Professor Sayce in his article on the origin of the alphabet in the *Contemporary Review* for December, 1885, "it is difficult to find any alphabet which cannot be affiliated to the Phœnician, widely different as the two may have become both in the forms of the letters and in the values they bear. Intermediate forms are continually being discovered, which bridge over the enormous distances and explain the transitions that time and space have effected. Even the Devanâgarî alphabet of Sanskrit, whatever disputes there may be as to its exact pedigree, is generally allowed to be of Phœnician origin. With the exception of the cuneiform alphabet of the ancient Persians, and possibly one or two more which may yet lurk in obscure corners of the world, all the alphabets of which we know are derived, ultimately, from a single source. Utterly diverse as they are in their latest forms, the zealous enthusiasm of palæographists and inscription-hunters has succeeded in restoring them to their earlier shapes, in filling up the intervals which separate them from each other, and in showing that they are all but the manifold developments of a single germ. The history of the alphabet, in short, like the history of its origin, is but an illustration of the doctrine of evolution on a large and easily tested scale. 'Scientific palæography,' to use again the words of Dr. Taylor, 'rests on the assumption that no alphabetic changes are ever accidental or arbitrary, as was formerly assumed, but are the result of evolution taking place in accordance with fixed laws.'"

How vividly the language and methods of work employed by these scholars recall the language and methods of the philosophic biologists in their attempts to seek the missing links and ancestral forms of life which complete and unite the chain of being!

——The bestiarians in Belgium have appropriately united with the antivaccinationists in the publication of a journal entitled The Friend of the People. In Paris and in Philadelphia the anti-vivisection societies have modified their titles so as to state that their object is to regulate, and not to abolish vivisection. To such a service reasonably executed, no one should object. However our hopes of rational conduct on their part, are somewhat abated by the addresses delivered by some of their members. It is still asserted in Philadelphia, that no benefit to physiological science has been derived from vivisection! In Paris a lady member denounces the experiments made by Pasteur in the search for the methods of attenuating animal poisons, declaring that it were better to endure rabies than tolerate the (?) cruelties inflicted on animals by Pasteur.

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RECENT LITERATURE.

COULTER'S ROCKY MOUNTAIN BOTANY.[1]—This neat manual, in its substantial binding, good paper and excellent typography, reminds one every way of the well-known Gray's Manual, of which it is, in fact, designed to be a companion volume. It is intended for use in the region lying between the 100th meridian on the east and the Great basin on the west, and extending from the northern line of New Mexico northward to the British boundary. Its range, therefore, includes Colorado, Wyoming, Montana, Western Dakota, Western Nebraska and Western Kansas.

There are several features of the book which are especially noteworthy. In it we have for the first time, so far as we are aware, an American manual of botany with the gymnosperms standing in proper relation to the angiosperms. The outline of the arrangement is as follows, viz:

Series I. PHÆNOGAMIA.
  Class I. ANGIOSPERMÆ.
    Sub-class I. Dicotyledons.
    Sub-class II. Monocotyledons.
  Class II. GYMNOSPERMÆ.

Series II. PTERIDOPHYTA.
  Class I. LYCOPODINÆ.
  Class II. FILICINÆ.
  Class III. EQUISETINÆ.

As indicating further the modern views held by the author, a

[1] *Manual of the Botany* (*Phænogamia and Pteridophyta*) *of the Rocky Mountain Region* from New Mexico to the British boundary. By JOHN M. COULTER, Ph.D., professor of botany in Wabash College and editor of the *Botanical Gazette*. Ivison, Blakeman, Taylor & Co., New York and Chicago., 1885, pp. xvi, 454, 28.

remark in the preface is worth quoting, viz: "The term 'cryptogam has been discarded as the correlative of phænogam, and 'Pteridophyta' (vascular cryptogams) is used as the name of the second great series of plants." It is gratifying to note these signs of a recognition, in a systematic manual, of the doctrine of evolution, and of the significance of the structural homologies which are now familiar to every vegetable anatomist.

We wish the author had been entirely consistent in his treatment of this part of the subject. Thus, if we consider the gymnosperms to occupy the position given them in this bock, we must regard the cone (in conifers) as the homologue of the *female flower* of angiosperms, and not as an ament (*i. e.*, a spike of flowers). The so-called "spikes" of Lycopodinæ and the similar structures (male and female cones) of the conifers are so clearly homologous as not to require any discussion here; and this precludes the use of the old term "ament." In another case we notice the continued use of an antiquated term where the leaves of the Filicinæ are called "fronds." In the characters given for the class (p. 436), as well as the ordinal ones, the leaves are called leaves, with the word "frond" following in parenthesis, but in the generic and specific descriptions the old term alone is used, except in the Rhizocarpæ. We have no doubt whatever as to the author's real views upon these points, and rejoice that he has, even in part, succeeded in securing a better arrangement and a more modern nomenclature, and only regret that it was not possible to carry out in full the reform so well begun.

We find by calculations made by us that the area of the region included in this book is but little less than that included in Gray's Manual. It is interesting to notice that the number of Rocky mountain plants is wonderfully near to that of the Eastern region. Doubtless when the Western region has been as fully explored, it will have a greater number of species than the Eastern. We give below the comparisons for the different groups:

	ORDERS.		GENERA.		SPECIES.	
	Coulter.	*Gray.*	*Coulter.*	*Gray.*	*Coulter.*	*Gray.*
Polypetalæ.....	38	48	176	255	624	629
Gamopetalæ.....	23	33	181	289	683	751
Apetalæ.....	14	24	48	70	166	187
Dicotyledons.....	75	105	305	614	1473	1567
Monocotyledons...	13	22	104	174	347	670
ANGIOSPERMS.....	88	127	409	788	1820	2237
GYMNOSPERMS.....	2	1	6	8	16	21
PHÆNOGAMIA.....	90	128	415	796	1836	2258
PTERIDOPHYTA...	7	4	19	28	45	90
Total.....	97	132	434	824	1881	2348

Comparing the number of genera and species for half a dozen orders, the following interesting results are obtained:

	GENERA.		SPECIES.	
	Coulter.	*Gray.*	*Coulter.*	*Gray.*
Leguminosæ	20	35	143	98
Rosaceæ	26	18	65	72
Compositæ	83	85	357	288
Ericaceæ	10	28	19	67
Cyperaceæ	8	15	108	247
Gramineæ	48	66	129	168

As to the number of species common to the two regions, we have space for but a few comparisons. Taking a few of the orders as they occur at the beginning of the book, we obtain the following results, confining our comparisons to *native species* only, as in the previous cases:

	NUMBER OF SPECIES.		
	In Coulter.	*In Gray.*	*Common to both.*
Ranunculaceæ	57	54	24
Berberidaceæ	2	5	0
Nymphæaceæ	2	6	1
Papaveraceæ	2	2	0
Fumariaceæ	5	7	1
Cruciferæ	63	46	17
Capparidaceæ	7	1	1
Violaceæ	9	17	5
Polygalaceæ	3	14	1

No better argument as to the need of this book can be made than that derived from this comparison, which indicates that not more than about one-third of the Rocky Mountain species are described in Gray's Manual.—*Charles E. Bessey.*

THE CATALOGUE OF LIZARDS IN THE BRITISH MUSEUM, new edition, Vols. I and II.—This important work, by Dr. G. A. Boulenger, fills a desideratum in zoölogy which is of long standing. Previous to the publication of these volumes Dr. Boulenger had given us in the *Ann. and Mag. Nat. Hist.*, 1884, p. 117, a synopsis of the families of existing Lacertilia, as understood by him. The classifications of Duméril and Bibron and of Gray, still generally in use, are regarded as unnatural, and the osteology and structure of the tongue as well as the presence or absence and structure of the dermal ossifications are put forward as characters of primary importance. In this respect Cope is largely but not entirely followed. Twenty families of *Lacertilia vera* are recognized, separated into three series, the first (Gecconidæ, Eublepharidæ) with smooth tongue and the clavicle dilated and loop-shaped proximally; the second without the latter character, while

the third differs from the others in the scale-covered structure of the tongue. The Amphisbænidæ are regarded as a degraded type of Teiidæ, and are placed in the third subdivision, between that family and the Lacertidæ. The chameleons alone form the suborder Rhiptoglossa. The Uroplatidæ are discovered to differ from the Gecconidæ in the proximally simple clavicles and other important characters; the Scincoids of Duméril and Bibron are scattered through several families, in accordance with the views of Cope; the remaining Scincidæ corresponding to Cope's Scincidæ, Sepidæ and Acontiidæ; the Zonuridæ comprise the genera Zonurus, Platysaurus and Chamaesaura; while the Anguidæ include Cope's Anguidæ and Gerrhonotidæ. He admits Cope's family Aniellidæ, regarding it as a degraded form of Anguidæ. A family Gerrhosauridæ is established for Gerrhosaurus, which is placed near the Scincidæ; the Anelytropidæ are regarded a degraded type of the Scincidæ, and the degraded genus Dibamus is, among the scale-tongued lizards, the equivalent of the Aniellidæ in the smooth-tongued series.

Of this system it may be said that it is a great advance over any that has yet been adopted in any European country. There are, however, a good many important characters of the skeleton which have not been used by Dr. Boulenger, and which give ground for a further subdivision of the order Lacertilia. The affinities of the families cannot, in fact, be estimated without them. The form of the proötic bone is one of these, and the enclosure or non-enclosure of the olfactory lobes of the brain by the frontal bones is another. The mode of articulation of the occipital sclerotome presents important differences. Some of these characters divide his group second into groups of equal value with his groups I and III; and others indicate a greater difference between the Amphisbænians and the Teidæ than Dr. Boulenger admits. The composition of the ramus mandibuli affords important characters, so as to distinguish readily the Anolidæ and Acontiidæ, families not admitted by Boulenger.

This work is, however, the best we now have on the subject, and will give a great impetus to its study.

A second preliminary paper is devoted to the geographical distribution of the Lacertilia. He notices the parallelism, first noticed by Wagler, between the Agamidæ and Lacertidæ of the old world and the Iguanidæ and Teiidæ of the new. The Central American fauna presents a greater variety of types than South America, as it has representatives of every one of the eleven Neogean families. A review of the distribution of types in the four generally accepted zoögeographical regions of the old world leads to the conclusion that these "regions" are not supported by the Lacertilia, which range also according to longitude rather than latitude.

HARTMAN'S ANTHROPOID APES.—The author is well known as a special student of the apes, and has given us in this book perhaps the most authoritative and judicious work upon these creatures yet published. The illustrations are in nearly every case of value, and the facts are presented in a clear, simple style which adds weight to the author's views. As we see nothing to criticise, we will draw the reader's attention to some of the author's statements and conclusions.

The discussion on the ape-like characters of the lowest human tribes is of much present interest. Hartman shows that among some human races "it is impossible not to recognize a purely external and physical approximation to the simian type." Yet old specimens of apes, especially the gorilla, differ more from man than the young, and the author is strongly of the opinion "that man cannot have descended from any of the fossil species which have hitherto come to our notice, nor yet from any of the species of apes now extant." He adopts Vogt's view "that both types have been produced from a common ground-form, which is still more strongly expressed in the structure of young specimens, because the age of childhood is less advanced." Hartman adds: "This supposed progenitor of our race is necessarily completely hypothetical, and all the attempts hitherto made to construct even a doubtful representation of its characteristics are based upon the trifling play of fancy." On page 300 he remarks: "Moreover, the most fanatical advocates of the doctrine of descent are becoming ever more convinced that man cannot be the issue of any extant form of anthropoids."

Hartman in his classification of the Primates places man in the same family as the apes, man forming the type of the subfamily Erecti, and the apes, including the gibbon, in the subfamily Anthropomorpha. To place man in the same family as the apes is, we think, an extreme view, nor is the author logical in doing so, since he believes that man has not descended from any known ape, a view with which we would agree. But throughout the animal kingdom, as a rule, it is eminently probable that all the members of a family, zoölogically considered, have descended from a common ancestor. On this ground as well as from anatomical considerations, we should refer man to a distinct, special family.

KANE'S HAND-BOOK OF EUROPEAN BUTTERFLIES.[1]—A handy little book is this for the butterfly-catcher. The introduction gives the best localities and the distribution of species, methods of capture and of preservation when captured, apparatus, a full glossary of terms, arguments on seasonal dimorphism, etc. This is followed by fifteen plates and 149 pages of generic and specific descriptions. A well-chosen set of abbreviations is used, and the work is thoroughly indexed.—*L.*

[1] *A Hand-book of European Butterflies.* By W. F. DE VISMES KANE, M.A., M.R.I.A. London, Macmillan & Co., 1885.

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PLATE XIV.

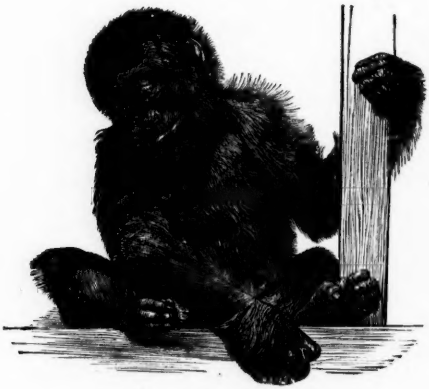

FIG. 1.—Young male Gorilla.

FIG. 2.—Same as Fig. 1, but somewhat older.

LANGILLE'S OUR BIRDS AND THEIR HAUNTS.[1]—This is an out-of-door book by an out-of-door student of birds, and bears witness to much patient observation. The faults which an evolutionist may find in it will endear it to all those who instead of believing that function precedes structure, put the latter first and make it push its own motor. It seems strange that a working naturalist should suppose that birds are supernaturally fed, and should ask "when are they starving or wanting sustenance?" as though half-starved birds are not abundant in winter, and as though none perished! The book is wordy, or as its author would probably say, one of the most remarkable characteristics of the volume is its extraordinary verbosity.

Everybody is quoted; Wilson, Audubon, Thoreau, Coues, Burrough, Wallace, Dall, Maynard are presented in long paragraphs; there are bits of many a lesser light of zoölogy, and several "distinguished taxidermists" figure in the pages.

There is a good deal of information in the book, and moral lessons and quotations are quite as prominent as ornithology. The book is handsomely printed.

OUR LIVING WORLD.[2]—This serial natural history has now been completed, parts 33–42 having been received. We have already given samples of the elegant wood-cuts which adorn the well-printed pages. The oleographs in the last numbers are excellent. The excellence of the illustrations gives the chief value to the book, which is of interest to the young rather than to the scientific student, since none of Mr. Wood's writings are above criticism. The illustrations of the insects are entirely of exotic species. Such a work as this, whatever may be its scientific defects, is worthy of wide circulation, as it leads the young to thirst for knowledge of a more exact and detailed nature.

THOMPSON'S BIBLIOGRAPHY OF PROTOZOA, ETC.[3]—A bibliography of all works and scattered articles relating to animals lower in the scale than arthropods, mollusks and echinoderms fills a long-felt need. The author modestly states that he knows there are many omissions to be discovered in his list, and begs those who use it to judge these leniently and to help him to make them good. The specialist who finds fault with these 256 pages, full of the results of hard and, to the worker, dry work, must indeed be ungracious.

[1] *Our Birds and their Haunts*, a popular treatise on the birds of Eastern North America. By Rev. J. HIBBERT LANGILLE, M.A. Boston, S. E. Cassino & Co., 1884.

[2] Published by Selmar Hess, New York. Complete in forty-two parts at fifty cents each.

[3] *A Bibliography of Protozoa, Sponges, Cœlenterata and Worms*, including Polyzoa, Brachiopoda and Tunicata, for the years 1861–1883. By D'ARCY W. THOMPSON, B.A. Cambridge University press, 1885.

RECENT BOOKS AND PAMPHLETS.

McIntosh, W. C.—Report of the Annelida Polycheta collected by H. M. S. *Challenger* duriug the years 1873-76. Challenger reports, Vol. XII, 1885.

Smith, E. A.—Report on the Lamellibranchiata collected by H. M. S. *Challenger.*

Selenka, E.—Report on the Gephyrea collected by H. M. S. *Challenger.*

Sars, G. O.—Report on the Schizopoda collected by H. M. S. *Challenger.* The last three from Vols. XIII of the Challenger reports, 1885. All from J. Murray, Challenger office.

Williams, A., Jr.—Mineral resources of the United States. Calendar years 1883 and 1884. U. S. Geol. Survey, 1885. From the author.

Iddings, J. P., and Cross, W.—Widespread occurrence of Allanite as an accessory constituent of many rocks. Ext. Amer. Jour. of Science, Aug., 1885. From the authors.

Kiprijanow, W.—Les remarques pour la IIIme partie "Ueber die fossilen reptilien Russlands." From the author.

Lewis, T. H.—Effigy mounds in Iowa. Ext. Science, No. 146, 1885. From the author.

James, E. J.—Outline of a proposed School of Political and Social Science. Read before the Phila. Soc. Sci. Ass., Phila., 1885. From the author.

Bocourt, F.—Note sur un Boidien nouveau, provenant du Guatémala. Ext. Bull. d. l. Soc. Phil. de Paris, June, 1885. From the author.

Newberry, J. S.—Notes on the geology and botany of the country bordering the Northern Pacific Railroad. Ext. Ann. N. Y. Acad. Sci., Vol. III, 1884. From the author.

Barrows, W. B., Elliot, D. G., Stejneger, L., and Kingsley, J. S.— The Standard Natural History. Vol. IV. Birds. Boston, S. E. Cassino & Co., 1885. From the publishers.

Cope, E. D.—Report on the coal deposits near Zacualtipan, in the State of Hidalgo, Mexico. Read bef. Amer. Phil. Soc., Oct. 16, 1885.

——Origin of man and the other vertebrates, and the Energy of life evolution. Rep. from Pop. Sci. Monthly, Sept. and Oct., 1885.

——The sternum of the Dinosauria. Amer. Nat. extra, Feb., 1885.

——Structure of the brain and auditory apparatus of a theromorphous reptile of the Permian epoch. Read before the Amer. Phil. Soc., Oct. 16, 1885. All from the author.

Baur, G.—Bemerkungen über den "Astragalus" und das "Intermedium tarsi" der Saugethiere. Sept., 1885. From the author.

——Zur Morphologie des Carpus und Tarsus der Reptilien. Sep.-Abd. a. d. Zool. Anz., No. 208, 1885.

Bardeleben, K.—Ueber neue Bestandteile der Hand- und Fuss-wurzel der Saugethiere, etc. Sonder abd. a. Supplement-Heft III d. Zeit. f. Naturw., Bd. XIX, N. F. XII. From the author.

Davidson, T.—On a living spinose Rhynconella from Japan. Ext. Ann. and Mag. Nat. Hist., Jan., 1886. From the author.

Peirce, C. N.—Function; its evolution and influence on organization. Read before the N. Y. Odontological Soc., Nov. 10, 1885. From the author.

Lightall, W. D.—An analysis of the altruistic act. Montreal, 1885. From the author.

Wilder, B. G.—The names of the encephalic arteries. Rep. N. Y. Med. Journal, Nov. 28, 1885. From the author.

Wood, T. F.—Sketch of the Botanical work of Rev. Moses A. Curtis. Raleigh, 1885. From the author.

Ramsay, E. P.—Description of the marsupial egg of *Echidna hystrix.* Ext. Ann. and Mag. Nat. Hist., Dec., 1885. From the author.

Boulenger, G. A.—Remarks on Mr. C. W. de Vis's recent contributions to the herpetology of Australia. Ext. Ann. and Mag. Nat. Hist., Nov. 1885.

Boulenger, G. A.—A list of reptiles and batrachians from the Island of Nias. Ext. idem.

——Descriptions of three new species of Geckos. Ext. idem.

——Descriptions of new species of reptiles and batrachians in the British Museum. Ext. idem. All from the author.

Abbott, H. C. D.—A chemical study of *Yucca angustifolia*. Ext. Proc. A. A. A. S., Ann Arbor meeting, 1885. From the author.

Congrès Geologique.—Liste des membres du bureau et des membres présents á Berlin. 1885.

Kunz, G. F.—Precious stones. Dept. of the Intr., 1885. From the author.

Mather, F.—Adirondack survey. Zoölogy. Adirondack fishes, with descriptions of new species. Albany, 1886. From the author.

Peale, A. C.—Mineral waters. Abs. Min. Res. U. S. 1883–84. Dept. of the Interior. From the author.

Wachsmuth, C. and Springer, F.—Revision of the Palæocrinoidea, Part III. Phila., 1865. From the anthors.

Fritsch, A.—Fauna der Gaskohle und der Kalksteine der Permformation Böhmens, Bd. 2, Heft 2. Schluss der Stegocephalen. Prag, 1885. From the author.

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GENERAL NOTES.

GEOGRAPHY AND TRAVELS.[1]

GENERAL.—Dr. T. Fischer, in Petermann's Mittheilungen, maintains that when oceanic agencies alone have formed the coasts, it consists of a succession of arcs, in the case of steep coasts with a short, and of flat coasts with a long radius. Where the coasts exhibit other features, other causes, as movements of the earth's crust, are either more powerful or are very recent.

ARCTIC REGIONS.—The Danish expedition to the east coast of Greenland returned to Copenhagen, Oct. 2d, after an absence of nearly three years. Besides the collection of valuable scientific material, Lieut. Hahn has made some important geographical and ethnographical discoveries. He wintered between latitudes 65° and 66° and reached 66.08° N., the highest point yet visited by Europeans on the coast. He has named the stretch of coast explored Christian IX's land.

The area of Store Baergefjeld, in Arctic Norway, has been represented as an immense glacier field. The observations of Chas. Rabot show that there are nearly seven secondary glaciers, hardly passing beyond the stage of *névé*, and that their total area does not exceed six kilometers. The region is not a plateau, but to the north a mountain mass with summits nearly 6000 feet high, and averaging 3600 feet; and to the south a densely wooded table-land cut up by cañon-like valleys. Rabot has also found that three distinct chains of mountains, reaching a height of more than 3000 feet, exist in the Kola peninsula, between the White sea and Arctic ocean. The district is usually shown as a plain, broken

[1] This department is edited by W. N. LOCKINGTON, Philadelphia.

merely by lakes and low hills. Between the ranges the land is level, and trees of good size reach 63° 50′ N. lat.

AFRICA.—*The Resources of Africa.*—A pamphlet by Dr. A. Fischer, entitled "*Mehr Licht im dunkeln Weltteil*," is interesting as giving the most unfavorable view possible of the resources of Africa, and may be useful to those who have been too much carried away by the enthusiastic reports of travelers.

Dr. Fischer gives the total exports and imports of Zanzibar at £1,750,000, and the total value of the exports of the west coast at £2,450,000. The total annual yield of ivory he estimates at £800,000 in value, and 1,760,000 lbs. in weight. This trade, which with great truth Dr. Fischer regards a curse to Africa, since it diverts the energies of both natives and traders from agriculture, costs the lives of 40,000 elephants annually. The elephant is almost exterminated along the coast over a width of 130 to 200 miles, and is no longer to be found in South Africa. Caoutchouc in East Africa is being rapidly exterminated by the unskillful and improvident way in which the juice is collected. Gum copal, since competition with Australia, has so sunk in price as not to pay unless with slave labor. Dr. Fischer takes also a desponding view of the agricultural capabilities of Africa. On the whole, however, his statistics prove rather the need for settled government and economical exploitation of resources than any unfitness of African soil for colonization or production. Statistics show that the trade of Africa is growing, and coffee, which he maintains cannot be profitably cultivated without slave labor, is a success in Liberia.

Lieut. Wissman's Expedition.—Lieut. Wissman's expedition down the Kassai throws new light on the geography of the Congo basin. The Sankuru, or lower course of the Lubilash, unites with it by two arms 830 and 1000 feet wide; a river which Lieut. Wissman believes to be the Loangwe, though at its mouth it is known as the Temba, flows in lower down; and still lower the great Cuango and the Mfini from Lake Leopold unite their waters with it. Below the Sankuru the Kassai is 3300 yards wide, and lower down, before receiving the Cuango, it spreads out to 10,000 yards or more, and is dotted with islands and sand banks. Its lower portion, known as the Kwa, is narrow, not more than 450 yards, but deep and rapid. The Ruembé, Chibumbo, Luachim, and Chikapa are affluents of the Kassai. Luluaburg is a station established by Wissman on the Lulua, some distance above its confluence with the Kassai. The river voyage commenced at Lubuku, the residence of Mukenge. Below the confluence of the Lulua the native name is Savié. The natives here are Barkuba on the right bank, Bashilelé on the left. Lower down, below he Sankuru, reside the Badinga and Bangodi, and still lower the Btakuta, who were hostile to the explorers, and are reputed cannibals. Still nearer the junction of the Cuango are the Baduna.

African News.—The native population of the Gaboon region is, according to Dr. Lenz, being rapidly driven towards the interior by the Fans. The Germans have annexed the country lying behind the French possessions at Great and Little Popo, on the Gold coast.——M. G. Angelvy, a French engineer in the service of the Sultan of Zanzibar, reports that he has discovered coal of excellent quality on the Lujenda tributary of the Rovuma. The great drawback is the distance from the coast, all the more to be regretted since beds of siderite lie near. The Rovuma, though 2000 feet wide, is but a foot to a foot and a half deep. The sultan intends to work the coal-beds, and to construct a road or railway to Lake Nyassa. Sir John Kirk, in a letter accompanying that of M. Angelvy, states that the coal region lies sixty miles south of the latitude of Delgado bay, and a question of inland frontier is therefore likely to arise between the Sultan of Zanzibar and Portugal.——At Tunis a modern French town is being built between the native city and the lake. Land is being rapidly brought under cultivation, taxes reduced, roads constructed, and the country in every way improved.——M. Moller has proved that the peak of St. Thomas is the highest land in the island of that name, and is 2142 meters high.——The November *Bulletin della Società Geographica Italiana* contains a letter from De Brazza, describing a voyage undertaken from Brazzaville to the Licona or Ncunda. The name Congo is not known by the Apfurus and Bateke, who speak of it as the Great river. The village of Bonga at the mouth of the Alima is large and picturesque, it is intersected in all directions by canals, and the houses, some fifty meters long, form streets. Down the wilderness of canals is brought the large quantity of manioc grown upon the Alima, for the supply of the natives of the Congo banks, which in this part are unfitted for the growth of manioc. De Brazza says that it will be half a century before the labyrinth formed by the various channels of the Congo above Stanley pool is correctly mapped. For eight days, he says, "we believed we were on another river, and found after all that we were on the Congo." The Apfurus and Bayansi are the same people.——H. Entz and A. Mer have, after a careful study of the voyage of Hanno, the Carthaginian, come to the conclusion that it terminated at Fernando Po. Thymaterion is identified with the town of Mazaghan, and the promontory of Soloé with Cape Cantin. The Lixus is by Mer identified with the Senegal, by Entz and others with the Draa. The island of Cerné is probably Goree and the Western Horn answers to the Bight of Benin.——Sister Cipriani, one of the prisoners taken by the Mahdi, now freed through the endeavors of M. Sagaro, states that Khartoum is almost deserted, but that Omdurman is now populous and has become a second Mecca, the Arabs coming from all parts to the Mahdi's tomb, which is a day's journey from the place. Lupton Bey, Slatin, the commercial traveler Cuzzi, and two

Frenchmen, one a journalist, are prisoners with the Caliph Abdullah at Omdurman.——The German government has published the annexation of the territory called Usaramo in west equatorial Africa; and has occupied Dar-es-Salam, a port opposite to Zanzibar.——The King of Dahomey has abolished human sacrifices in virtue of a treaty entered into between him and the Portuguese governor of San Principe, and a Portuguese protectorate is by the same treaty established over the sea-coast of Dahomey.

ASIA.—*Southern India.*—From some notes by Col. B. R. Branfill, it appears that *Ghat* means a pass and that monsoon is derived from the Arabic *mausim*, which means season. The south-west monsoon, which blows from May to September, is supposed to be the great sea-breeze produced by the rarefaction of the air in the drier parts of Asia, while the north-east monsoon is the ordinary trade-wind. March, April and May are the hot season of Southern India, the north-east monsoon succeeding it. The south-west monsoon parts with its moisture on the Malabar coast, and gets warmer and drier as it blows over the table-land of Mysore. The north-east monsoon fills the rivers and tanks of the drier Carnatic plain to the east of the ghats. The ghats are not very high, and when viewed from the table-land enclosed by them, seem rather a battlemented parapet than a range. A leading feature of the western ghats is a long easy slope, crested with forest, leading up to a cliff overlooking the coast-plain. Such a cliff-summit is called a *Kadure-Mukh* or horse-head. The eastern ghats have no such well-marked line of precipices as the western. Most of the drainage of Mysore, which undulates from two to three thousand feet above the sea, is to the eastward. The larger rivers have deep and rocky channels, but the smaller are converted into series of reservoirs until there is no room for more dams. There are nearly 40,000 such tanks in Mysore, the largest some twenty miles around. The River Cauvery is thus utilized throughout the province. On it are situated the former capital, Seringapatam or Srirangapatnam, which is now deserted, and is a pestilential wilderness, and the ruins of the more ancient capital of Talkad, now buried in sand save only the pinnacles of the temples. In the Wainad or open country of the western highlands, south of Coorg, gold-mining has been commenced, and there are many traces of ancient workings. S. S. E. of the Wainad lies the nearly isolated plateau of the Nilgiri hills or Blue mountains, rising on the western edge to 8000 feet or more, while Dodabetta, a conoidal mass with steep slopes covered with grass and woods, rises from its center to a height of 8640 feet. These hills are the home of the Todas. The Nilgiri hills, though separated from the main table-land of Central India by the Moyär ravine, form really its southern termination. South of them is the Palghät gap, leading from Malabar to the south-central lowlands of Coimbatore and Salem. South of the gap the mountains rise

again as the Anamalai or Elephant hills, and farther south, the Travancore hills. These are a true mountain range, rising directly on all sides from the lowlands, and are steepest on their eastern slopes. The highest measured point, Anamudi or Elephant's brow, is 8840 feet above the sea, and the loftiest known peak in Southern India. This range, called also the Southern ghats, ends at Cape Comorin. To the east of the Anamalai hills lies the lofty plateau of the Palani hills, in two steps, the upper 7000 feet high. Groups of similar but minor masses of hills are met with at intervals eastwards and northwards, surrounding the lowlands of Coimbatore and Salem, perhaps once the seat of a former inland sea. South of the Palanis is a large tract of mountainous wilderness, occupied only by wild animals and wild men of the lowest types, who go unclothed, and feed on such fruits and roots as they can scratch up with their fingers. They can make a fire, but seldom do so, and gather cardamoms, honey and other wild produce to exchange with their more civilized neighbors for salt, grain, and a little cloth to adorn their women. There are no harbors worthy of the name on the usually low Malabar coast, but a chain of lagoons affords inland communication for several hundred miles. Cape Comorin is a low rocky promontory. Once there was a harbor, town, and pearl market, but now nothing is left but the temple of Kanyâ Kumâri, the "Virgin Maid," still a resort for devout Hindus. Korkai, the Kolchoi of Greek geographers, an emporium 2000 years ago, is now three miles inland, its successor Kâyal (the lagoon), mentioned by Marco Polo, is now deserted by the sea, and the present port of Tuticorin promises to be in turn silted up. All the rivers of Southern India tend to shift their mouths northwards from the action of the ocean rollers. The Coromandel coast is marked by a line of sand-hills with lagoons here and there on the landward side, and there seems to be an advanced line of coast in course of formation several miles out to sea. There is much coral in the Gulf of Manar. Besides the changes occurring on this coast from constant causes, storm waves have destroyed many ancient cities and ports.

Asiatic News.—A ruined city, hitherto unknown, has been found in Adana, Asia Minor, not far from Tarsus, near the route from Sélef-Ké to Karaman. Sarcophagi like those of Lycia exist almost intact.——Residents of Siberia are organizing an exploration to investigate for five years the ethnology and social economy of that vast region. Young men will be distributed over the country for that purpose. A railway from Ekaterinburg to Kamishoff is completed; and the canal between the Obi and Yenisei will probably be ready for navigation at the latest in the spring of 1887. Sibiriakoff has established a line of steamers on the Angara, between Lake Baikal and the Yenisei.——M. Daniloff believes that he has found the point of bifurcation of the Oxus into the Amu Daria and the Uzboi or Unguz.——A recent French

writer describes the route from Lao-Kai on the Red river of Tonquin, to Mengtsze in Yunnan. He is not enthusiastic about any of the routes from Tonquin, though he thinks France has as much chance of getting the China trade as any of her rivals. The route from Lao-Kai to Manhao is by river, but from the head of navigation to the plateau of Yunnan the coast is extremely difficult and mountainous.——Commander Réveilliere has succeeded in passing the rapids of the Meikong, beyond Samboc, the chief Cambodian town on the river, in a steamer. These rapids are at present a bar to navigation, but M. Réveilliere is convinced that it is formed of nothing more than a mass of trees permanently freed and added to every year. The town of Strung-Treng where most of the commerce of the Laos reaches the river, is above the rapids.

GEOLOGY AND PALÆONTOLOGY.

THE ENGLISH CRETACEOUS.—With the Cretaceous, or rather with that indefinite age which intervened between the close of the Cretaceous and the dawn of the Eocene, unrepresented by any stratified rock in England, we close the book on the evolution of Gymnosperms for nearly all the archaic anomalous genera which held the place of our larches, pines and spruces, cypresses and junipers, had given way to living genera and even species.

It is a remarkable fact that the extermination of so much that was preëxisting of both the marine and terrestrial fauna, embracing nearly all the armoured cephalopods and the gigantic saurians which had till then occupied the foremost place, should have been accompanied by a similar wholesale disappearance among plants. To suppose that this period was an exceptionally fatal one, annihilating entire orders of the animal kingdom, is to admit, in the complete absence of evidence, a break or jerk in the majestic progress of life upon the earth which is repugnant to common sense; and it is more consonant with our present views to suppose that we are in presence of one of those vast gaps in the geological record which we know must have occurred over and over again in every area upheaved upon which sedimentary rocks had been deposited. In turning from the last Cretaceous deposit in Europe, we seem, so far as the plant world is concerned, to finally break with the past, while the first deposit of the Eocene appears like turning over the first page of the history of things as we see them now. It is thus, perhaps, worth our while to turn aside for a moment to take stock as it were of the closing events of the Cretaceous, so far as we know them at present, in order to estimate the true nature of the apparently sudden bound in the usually stately unarmed progress of evolution.

It appears that during the chalk formation a great wave of depression passed across Europe, traveling from the West to the East, permitting the ingress of the Atlantic, and forming a gulf

over what is now Central Europe, which constantly increased in magnitude. We need not believe that this gulf was formed by any sudden catastrophe, for there is no reason to doubt that the sea conquered the land by the same methods and at somewhere about the same rate that it encroaches now, and that therefore its advance over many thousands of square miles of *terra firma* would be an exceedingly lengthened process. We cannot gauge the time this occupied, but we know that since the appearance of man Southampton water has been formed, and a tract between Alum bay and Studland, some fifteen miles long and five or six miles broad, has been swept into the sea, and several species like the mammoth have become extinct. The rate of the encroachment depends mainly on that of the subsidence and the original height of the land, but what has here been effected in a subsidiary area serves to show roughly how vast a time must have been needed for the chalk sea to have crept from Kent to the Crimea, and covered the enormous area of Europe over which its traces still remain. As the land subsided and became sea, blue and green muds were thrown down, to be succeeded in due course by the deeper deposits of chalk ooze. It would be physically impossible for chalk, supposing it to represent globigerina ooze,[1] to be

[1] True chalk is a pure white limestone, composed of the remains of Foraminifera, valves of Cytherina, excessively minute infusoria, cell prisms of Inocerami, sponge spicules, and other debris of organic life. It was, until recently, universally admitted to be a truly oceanic deposit, of similar nature to globigerina ooze, but Mr. Wallace, supported by the late Dr. George Jeffreys, has lately put forward the view that it was formed in shallow water. Its vast extent, homogeneous nature, and freedom from terrestrial impurity show that it must have been formed remote from land, while its larger organisms, mainly Echinodermata or sponges, are with some exceptions, such as are now met with in abyssal depths. Mr. Wallace laid some stress on the difference in composition of fresh globigerina ooze and chalk, as shown by analysis; but Mr. Murray has recently stated that the percentage of carbonate of lime varies from 40 to 95 in the ooze. The comparison took no account of the fact that the chalk had been elevated for ages, during which it has been ceaselessly removing some of its original constituents. Silica has been dissolved and re-precipitated as flint, its iron has been segregated into crystalline masses, its manganese into dendritic markings, siliceous sponge skeletons have been dissolved and replaced by calcite, calcite shells by silica, and aragonite shells removed entirely. Layers of chalk a foot in thickness have been reduced to an inch by the removal of lime in solution. The late Dr. George Jeffreys had not studied the chalk, and based his conclusion upon the mollusca only, and these chiefly of the chalk-marl, and seemed unaware that only the calcite shells remained in true chalk. Of these Terebratula, Pecten, Amussium, Lima, and Spondylus are the chief genera still existing, and all but the last are already known to inhabit water 1400 fathoms in depth. Moreover, if the chalk sea did not communicate with the Arctic ocean, as Prof. Prestwich and others believe, and was shut off from the Antarctic by land between Africa and South America, as there is also much evidence to support, its abyssal depths would have been warm instead of icy cold, and its former abyssal inhabitants, accustomed to warmth, would have sought shallower water now in order to find an equal temperature, and become, as George Jeffreys states them to be, a tropical assemblage. The blue and green muds of the *Challenger* pass into globigerina ooze with an increased depth, and their equivalents of Gault and greensand pass into chalk in exactly the same way. The alternative theory of Wallace, that chalk is decomposed coral mud, could not have been advanced by a geologist, as, while the chalk contains some well-preserved solitary corals, not a reef-building coral has ever been met with either in or surrounding it, nor even in any contemporaneous deposit.

directly formed on a former land surface, and we consequently find that it is invariably preceded by some more littoral quality of sediment. The nearer the original centre of depression or focus of subsidence, the older the green sands and Gaults must necessarily be; and the farther we recede from it in any landward direction the newer they will be. Now, apart from physical evidence, a comparison of the faunas of our chalk with those of any European bed correlated with it to the eastward would at once show that if one was older than another, it would be that of our area. Forms like Mosasaurus, which only appear in our very latest chalk deposits, abound in Cretaceous deposits of more central Europe; whilst others, such as Ichthyosaurus, found abundantly in our chalk marl, are, on the contrary, absent. The rapid increase in the development and proportion of long canaled and other Eocene-looking gastropods, culminating in the Danish Upper Chalk, indicates most conclusively a more and more recent period of deposition for the beds in which they occur. The littoral zone must in fact have been constantly traveling outward and forward, and accumulating only until the ever-increasing depth led to a change in the sediment. Thus, though beds of green sand or chalk may be perfectly continuous, with precisely the same lithological characters, it is absurd to assert that portions of it, when separated from each other by degrees of latitude and longitude, must be synchronous. So far from this, the chalk with flints of one locality must most certainly have been deposited synchronously with the chalk of another, and this in turn with the chloritic marl of another, and the greensand of another. The shallower water zones, such as the greensand, would travel forward so long as the sea continued to encroach, and along the farthest confines of the gulf would recede again when elevation set in without any chalk being deposited over them, so that some upper greensands might be newer than any chalk. It is probable that each minor zone was a zone of depth, characterised by the same quality of sediment, and a fauna to some extent peculiar to it, and which kept up with it as it traveled farther and farther landwards. There would thus be great similarity in the fauna of each zone at any interval of distance, and it might maintain its distinct charcteristics over the most extensive areas, without, for all that, its contents having lived synchronously over the whole area.

We have noticed that the Neocomian and Gault of England and Western France contain a varied and considerable flora, represented mainly by foliage and fruits of Coniferæ, without affording the slightest trace of the presence of angiospermous dicotyledons. Even the Gray Chalk and the Blackdown beds have only yielded conifers and a Williamsonia of Jurassic type. We cannot account for their absence by supposing our area to have been isolated, for in the preceding Wealden period neither its fauna or flora

differed from that of Europe. But when we reach Aix-la-Chapelle, we find the chalk and greensand resting upon beds containing a flora largely made up of dicotyledons, and still farther off, in the Cenomania of Bohemia, living genera such as Magnolia, and farther on still, equally developed dicotyledons in the supposed yet older Turanian. Such facts were hitherto completely inexplicable, but it now appears even probable that the interval required for the chalk to progress only 300 or 400 miles endured long enough to have permitted an enormous progress in the evolution of phanerogams. Nor does the 1200 or 1400 feet of vertical chalk remaining in our area at all represent the completed formation; for, as the prolonged subsidence finally ceased and gave place to an equally slow elevation, all the lessening zones of depth would travel back with the receding ocean, and leave a series of zones inversely arranged to that preserved to us. The planing action of the sea has removed all this newer series, just as it has planed away a further mass of the width of the English channel, and is slowly but inexorably cutting down to its own level all the zones that form its shore lines. The Eocene seas from beginning to end of the period were ceaselessly engaged in this work, and their enormous deposits of flint shingle mark how much of the chalk had fallen a prey to them. Nor has the chalk enjoyed any respite from the work of destruction down to the present day, so that what now remains is a mere fragment of what once existed. It was during the interval that elapsed between the formation of the newest chalk now left in England and the oldest Eocene that dicotyledons were introduced, and our existing flora practically came into existence. All the Upper Cretaceous floras of Europe also flourished during this interval, but we cannot say, with our imperfect record, exactly the order in which they came in, and must be content to regard them in a general way as far newer than they appear to be stratigraphically. The entire American Cretaceous series should, perhaps, also be placed somewhere in this interval, though those well qualified to judge regard its commencement as dating from an older period. Without this digression we could not have formed an adequate idea of the meaning of the "Cretaceous period" and so realized that the so-called Cenomanian and Turanian floras of Europe may belong to a completely different epoch to that represented by the same horizons in Kent and Sussex.—*J. S. Gardner.*

On Proscorpius osbornei Whitfield.—In an article with the title: "On a fossil scorpion from the Silurian rocks of America."[1] Mr. Whitfield has recently published a description and figures of a highly interesting animal, the *Proscorpius osborni* Whitf., which he had some time before made known to zoölogists, in a prelimi-

[1] In Bulletin of the American Museum of Natural History, Vol. 1, No. 6, p. 181 (October 10, 1885).

nary notice: "An American Silurian Scorpion,"[1] under the name of *Palæophonus osborni*. The animal is no doubt a real scorpion, and not an Eurypterid; but as a few of the characteristics ascribed to it by the author would seem to remove it very far from other scorpions and especially from the Palæophonoidæ, to which it appears to me to be closely related, I venture to offer a few observations on this arachnid, or rather, on Mr. Whitfield's interpretation of certain points in its organization. Of course I give no other weight than that of mere suppositions to the opinions I am going to express, being fully aware of the difficulty and perhaps rashness of offering criticisms on the description of a rather badly preserved fossil, without knowing the "corpus delicti" from actual inspection.

According to Mr. Whitfield, the abdomen (preabdomen) of his scorpion is provided with *six* long and broad ventral plates, and if this were true, this animal would of course be so different from the rest of the order, that it ought perhaps to be considered as the type of a group equivalent to all the other known scorpions taken together; for in all other scorpions there are only *five* such plates, the sixth (reckoned from behind) being reduced to a small sternite, situated between the bases of the pectinal combs. Such a form of the said ventral plate as described by Mr. Whitfield, would no doubt, as he himself aptly remarks, imply great modifications in the position and shape of the pectoral combs of the animal, and probably also in the structure of the whole inferior part of the body in front of the plate in question. But to me it does not seem necessary to admit that Proscorpius differs in so high a degree from other known scorpions. I strongly suspect, that *all* that is seen of the abdomen in Mr. Whitfield's specimen (with the exception only of the narrow border to the left, and, perhaps the posterior part of the equally narrow right-hand border) is formed *exclusively of the dorsal plates*. The whole upper side of the abdomen is broken or cracked longitudinally; the narrower, right-hand part, considered by Mr. Whitfield to be formed of the inside of the *ventral* plates, has perhaps an appearance different from that of the rest of the upper surface, only from having been more strongly depressed and crushed, and the apparently slightly greater lengths (in the antero-posterior direction) of the right-hand parts of the plates would seem to depend on the same cause. This interpretation easily accounts for the circumstance that in Mr. Whitfield's specimen the articulations between *all* the "ventral" plates (not only between the posterior ones) are *direct continuations* of the articulations between the "dorsal" plates, which is not the case in other, at least not in recent, scorpions. In these, in fact, the articulations between the first two or three dorsal plates do not correspond to or are continued by articulations on

[1] In Science, Vol. VII, p. 87 (July 31, 1885).

the ventral side of the body; for in these and perhaps in all scorpions, the dorsal plates increase in length, counting from front backward, so that the first plate is the *shortest* of all; whereas (at least in recent scorpions) the first *ventral* plate is *longer* than the following ones, corresponding in length and position to *two* or even *three* (2d and 3d, or 1st–3d) dorsal plates taken together.[1] If the above given interpretation is, as I believe, the right one, the want of *spiracula* on the plates needs no further explanation.[2]

Mr. Whitfield thinks that, whereas modern scorpions carry the tail (postabdomen) arched upward over the back, Proscorpius, and also Palæophonus, carried it in the opposite way, or curved *downward*. This would indeed be a character of fundamental importance in distinguishing the Silurian scorpions from all other members of the group; but to me it is impossible to find any stringent reason for adopting this strange hypothesis. In the first place, it would seem that the animal's gait would become exceedingly difficult and awkward, if it were to walk with its tail curved under the body; and when it wished to kill, with the sting, the prey which it had caught with the hands of the palpi, it would probably be obliged to thrust the palpus with the prey between its legs, under the body, in order to bring it within the reach of the sting—no doubt a difficult performance for the animal. That in the embryo of scorpions the tail is bent under the body, is of course no reason for believing that the tail retains that position after birth, in the earliest or Silurian species, rather than in Carboniferous and recent ones. As to Palæophonus, I do not entertain the least doubt of its having carried its tail in the same direction as living scorpions. It must be borne in mind that, when a scorpion is strongly depressed or flattened, the tail, on account of its being arched upwards and not allowing of being stretched out in a straight line backwards, cannot well turn the dorsal part of more than its *basal* joints upwards; the following joints become gradually more and more turned to one side or the other, so that the last joint or joints will be seen in profile, or even obliquely from below. Such is the case in the specimen of *Palæophonus nuncius* described and figured by Professor Lindström and myself.[3] The basal joints of the tail of this animal are destroyed but must have turned their upper or dorsal surface upwards, as they have left the impression of their ventral part on

[1] In a specimen of *Buthus 5-striatus* Hempr. et Ehr., for instance, whose abdomen (preabdomen) is $24\frac{1}{3}^{mm}$ long, the length of the first ventral plate is 6^{mm}, that of the first three dorsal plates taken together $5\frac{1}{2}^{mm}$.

[2] Even if the plates in question really were ventral plates, the first (or sixth, when counted from behind forward) would from its position seem to correspond to the anterior half of the first ventral plate in ordinary scorpions, and *not* to the small plate situated between the pectoral combs. The genital plate is, I believe, the sternite of the first *segment* of the abdomen, quite as the plate between the combs is the sternite of its second segment.

[3] Thorell and Lindström, on a Silurian scorpion from Scotland (K. Svenska Vetenskaps-Akademien Handlingar, Bd. 21, No. 9).

the stone; the next following joints are seen from the left side, the two last obliquely from that side and from below. In the Scotch Palæophonus described by Mr. Peach,[1] which is turned upside down, we consequently see that the basal joints of the tail turn their ventral part upward and that the last joints are viewed *obliquely from above*. As to Proscorpius the impression one receives from the figures is, that the tail shows the *dorsal* surface of at least three of the four joints still preserved, just as would be expected. Mr. Whitfield says, however, that it shows, *not* the upper or dorsal surface, but "the inside of the *ventral* or lower plates of the four anterior segments;" and as these plates have the same form and sculpture as the *dorsal* plates or parts of these segments or joints in ordinary scorpions, he concludes that in Proscorpius "the bending of the tail would be downward, and not over the back, as in more recent and living scorpions." Now it seems utterly improbable to me that *Palæophonus nuncius* and *Proscorpius osbornei*, which both belong to the Silurian age and which are in many respects closely related, should differ from each other in so important a particular as the direction of the tail. Perhaps it is not impossible that Mr. Whitfield is mistaken in referring what remains of the tail in his Proscorpius to the *ventral* part of the joints. But even if he is right in this, the fact can easily be explained, if we admit that the tail which, according to Mr. Whitfield himself, is *detached* from the body, or to use his own expression, "slightly displaced in relation to the last segment of the preabdomen," has also become *turned upside down;* in that case the joints of the tail would, when their ventral upturned surface had been destroyed, show the inside of their dorsal surface in precisely that position which Mr. Whitfield attributes to the ventral surface of the joint. That Proscorpius had its tail curved downward is, therefore, by no means proved by Mr. Whitfield's specimen.

As the walking limbs of *Proscorpius osbornei* are in a very bad state of preservation, it is no doubt difficult to decide with certainty whether this animal belongs to the ordinary two-clawed scorpions (Dionychopodes) or to the Apoxypodes, or those Silurian forms which have the tarsi pointed and clawless, or possibly armed with a single claw. Only one of the legs, the left one of the first pair, is, according to Mr. Whitfield, undamaged, and provided at the tip with *two* claws. This assertion, if right, would of course settle the question at once; but a close inspection of the figures of the animal makes me believe that that leg also is incomplete, being broken near the base of one—probably the last—of the joints.[2] The "bifid" ending of the leg on the figures does, in fact, not at all give me the impression of two claws, but resembles closely the also broken end of the right leg of the last pair in the figure of

[1] Ancient air-breathers, in *Nature*, Vol. XXI, No. 796, p. 297. Jan. 29, 1885.
[2] So it appears at least on pl. 20, fig. 1, in Mr. Whitfield's paper.

Palæophonus nuncius Thor. & Lindstr.[1] The joint was perhaps armed with a strong spine near the base (as is the case with the fifth joint in *Palæophonus nuncius*); at all events, the two joints have no resemblance to the claws of ordinary scorpions. But besides this, there are several other reasons for doubting that Proscorpius belongs to the Dionychopodes. In Palæophonus all the joints with the exception of the last, are *cylindrical* or nearly so; in other scorpions the *tibia* is compressed and *convex longitudinally* on the under side; and in this respect Proscorpius appears to have resembled Palæophonus and not the Dionychopodes. The tolerably well-preserved leg of the first pair of Proscorpius seems to show that most of the joints of the legs have been comparatively *short* in this animal, and in this particular also it resembles Palæophonus and differs from the Dionychopodes. The "crowding forward of the limbs and appendages" depends on the *shortness of the posterior coxæ*, and is a characteristic that distinguishes Proscorpius from the Dionychopodes, but not from Palæophonus. (It is not probable that Proscorpius differed from other scorpions in the number of the joints of the legs; if we assume that in the best preserved leg of Mr. Whitfield's specimen the first joint or coxa is concealed by the margin of the cephalothorax, and that the leg is broken at the base of the last joint, it would seem to consist of seven joints, quite as in all other scorpions.)

Another character, by which Proscorpius appears to be more nearly related to Palæophonus than to other, at least recent, scorpions, consists in *the transverse furrow*, which extends across the cephalothorax, so that its posterior part forms "a broad band, resembling a segment of the preabdomen." *The small size of the dorsal eyes* would seem to be a character, in which Proscorpius differs from the Eoscorpioidæ, to which it is referred by Mr. Whitfield; in this particular it resembles rather Dr. Hunter's and Mr. Peach's Scotch Palæophonus, being, as Mr. Whitfield justly remarks, also in its general aspect more like this scorpion than the probably eyeless Swedish species (*P. nuncius*). But though I believe that Proscorpius is nearly related to Palæophonus, it forms no doubt a good peculiar genus, characterized by the somewhat trilobed anterior margin of the cephalothorax, and more especially by the shape of the fingers of the *mandibles*, which, if they really had such a form in the living animal, as from Mr. Whitfield's figures they appear to have, differ materially from those of Palæophonus and all other known scorpions.

It will be seen from the foregoing lines, that I cannot find that Proscorpius differs essentially from the hitherto known scorpions in other respects than in the somewhat *shorter cephalothorax*, and *perhaps*, in the form of the *mandibles*. Its systematical position appears to me to be in the close vicinity of Palæophonus, and

[1] Thorell and Lindström, loc. cit., fig. 1.

especially of the Scotch scorpion referred to that genus by Mr. Peach. An additional reason to those given above for removing Proscorpius from the Carboniferous Eoscorpioidæ, and for referring this genus to the Apoxypodes, fam. Palæophonoidæ, may be found in its being, geologically speaking, almost contemporary with the Palæophoni, belonging, like these, to the Upper Silurian formation. As the Palæophoni, and all other more recent scorpions, are undoubted land-animals and air-breathers, and, as no traces of branchiæ have been shown to exist in Proscorpius, there is, I believe, no serious reason for considering that this scorpion is an aquatic animal, or that "we have here a link between the true aquatic forms, the Eurypterus and Pterygotus, and the true air-breathing scorpions of subsequent periods," as Mr. Whitfield supposes. Very strange, also, would it be, if the connecting link between the gigantic Eurypterids and the scorpions should be formed of such a little creature as *Proscorpius osbornei*, one of the smallest scorpions hitherto known—especially as this diminutive scorpion lived contemporaneously with the Eurypterids.—*T. Thorell, Sori, Italy.*

An Extinct Dog.—The remains of an extinct type of dog, differing widely from any of the ordinary wild or domestic dogs, have been recently described by Mr. J. A. Allen in the memoirs of the museum of zoölogy at Harvard college. The bones were found in Ely cave, Lee county, Virginia, one of the oldest of a group of caverns in limestone of Cambro-Silurian age described by Professor Shaler, of the geological survey of Kentucky. In general form the new dog was a short-limbed, heavy-bodied animal, resembling in its proportions a badger rather than a dog. The skull has not been found. Mr. Allen refers the remains to a new genus, under the name of *Pachycyon robustus.*

MINERALOGY AND PETROGRAPHY.[1]

Tin.—In the "Mineral Resources of the United States, calendar years 1883 and 1884,"[2] W. P. Blake describes the occurrence of "tin-stone," two miles from Harney city, in the Black hills, Dakota. This locality was discovered in June, 1883. During the following year a company was formed to mine the ore, and enough progress was made to show that the find was commercially of much importance. The ore is found in two distinct forms, viz: massive, in bunches with spodumene, feldspar and quartz; and granular, disseminated in greisen.[3] The principal vein, known as the Etta, is described as having a rudely concentric structure. The outer portion consists of a mixture of dark and light colored

[1] Edited by W. S. Bayley, Johns Hopkins University, Baltimore, Md.

[2] Washington, Government Printing Office, 1885.

[3] A rock with the microscopic characteristics of ordinary greisen, but containing albite instead of quartz.

micas, within which is a second belt of quartz and spodumene. Associated with the latter is the cassiterite in bunches, some weighing as much as fifty or sixty pounds. Inside of this second belt is a third made up of greisen, in which occurs the granular variety of the ore. The central portion within the third belt is principally a coarse mixture of quartz and feldspar. The spodumene crystals in the second belt are of enormous size. One of the largest, measuring thirty-six feet in length, is without a single flaw. The area of the tin-producing region is being constantly extended by new explorations, so that its limits cannot yet be definitely fixed. In addition to its occurrence in the rocks the mineral is also known to exist as "stream tin" in the water courses leading down from the hills into the surrounding plains.

PETROGRAPHICAL NEWS.—*Peridotites.*—The rocks of this class belonging to the "Cortlandt series" on the Hudson river near Peekskill, N. Y., are divided by Dr. G. H. Williams[1] into hornblende peridotites (Hudsonites of Cohen), and augite peridotites (picrites of Tschermak). The former are characterized by the structure so well seen in the case of "Bastite" or "Schillerspath," and called by Pumpelly and Irving, "luster-mottling." In the present instance this structure (for which the author proposes the word *poicilitic*) is due to the inclusion of olivine, or its alteration product serpentine, in hornblende. This hornblende is without crystal form and is filled with sharp little transparent crystals and opaque black needles. These latter occur also in the olivine and are identical with those which Judd[2] considers as of secondary origin. This view the author of the present paper combats. He thinks they are substances extruded during crystallization as incapable of forming a part of their host, like the silicates in metamorphosed limestones. The hornblende peridotites pass, by the assumption of diallage, into the augite variety. Occasionally these become schistose as the result of the action of great pressure. Colorless augite with diallage-parting, hypersthene, brown hornblende and well defined crystals of olivine are the most important constituents of this rock.——*Variolitic granite.*—The first notice of variolitic granite from Craftsbury, Vermont, appeared in Hitchcock's report on the geology of Vermont.[3] The author there described it as a fine-grained; white and highly feldspathic granite, with considerable black mica. Scattered through this base occur numerous spheroidal nodules of black mica, more or less flattened. This peculiar variety is only locally developed, the granite between Stanstead and Craftsbury, exhibiting no unusual appearance. It occurs most abundantly just south of the latter town. Recently it has been subjected to microscopical examina-

[1] American Jour. Science, v. XXXI, Jan., 1886, p. 26.
[2] Qt. Jour. Geol. Soc., v. XLI, Aug., 1885, p. 354. AMERICAN NATURALIST, Dec., 1885.
[3] Vol. II, p. 564, 1861.

tion by Kroustschoff.[1] The body of the rock is found to consist of orthoclase, completely filled with acicular colorless mica; plagioclase with its twinning lamellæ crumpled and broken; quartz, with liquid inclusions containing double bubbles, and occasionally flattened disks or rounded prisms of a light green, highly refractive mineral; calcite in small rhombohedrons; yellow-brown biotite intimately associated throughout with muscovite and calcite; and bipyramidal prismatic crystals of a colorless mineral, with an extinction of 9–10° against the long axis. The varioles are composed of a central kernel of about the same composition as the rock. Surrounding this is a zone sometimes of calcite, sometimes of quartz, in which the mica occurs. Towards its inner side the mica is arranged in concentric layers, with considerable calcite or quartz between. The central portion contains only calcite and mica. Toward the outer side the calcite diminishes in quantity and the granitic materials take its place. The exterior portion of the variole is composed almost entirely of feldspar and quartz, in which the biotite is concentrically arranged, while the calcite occurs only in isolated grains and rhombohedra. The calcite is regarded as an original constituent, since it is found included in the other minerals, and the varioles are supposed to be concretions. —— Porphyritic hyperite, a rock of granitic structure, composed of plagioclase, hypersthene and diallage, with hornblende, apatite, titanic iron and a little biotite as accessory constituents, is found at San Diego, Cal. Kroustschoff describes[2] the plagioclase as occurring both in the ground-mass and also in porphyritic crystals. The latter are developed most prominently in the plane of the brachypinacoid. Analysis shows them to have the composition $Ab_5\ An_1$.——Herman and Rutley[3] have been studying the devitrification products of glass, heated to a high temperature and allowed to cool suddenly. They find that "in solids free from flaws the devitrification appears to consist in the development of divergent groups of crystals, the divergence being usually limited by a net-work of minute joints, which give rise to small polygonal prisms. The crystalline groups in their respective prisms are banded by arcs of circles." The prismatic structure is approximately normal to the cooling surfaces and the divergent sheaves of the devitrification crystals advance from this surface inward by successive growths within the prism. If the substance however be not homogeneous, crystallization will take place around independent centres irregularly distributed, without reference to the cooling surfaces. In the absence of jointing the whole mass may become spherulitic. These spherulites in a few instances occur within sharply defined circular or approximately circular boundaries, and are

[1] Bulletin de la Société Minéralogique de France, VIII, p. 132.
[2] Bulletin de la Société Minéralogique.
[3] Proceedings of the Royal Society. v. XXXIX. No. 239, p. 87.

made up of little globulites, giving rise to a structure very like that of many of the obsidians from California and other parts of the West.——The natural glasses in the neighborhood of the nepheline basalt of Rossberg, near Darmstadt, are thought by Kroustschoff[1] to owe their origin to the solution in the basalt of foreign quartziferous rocks.

MINERALOGICAL NEWS.—The asterism of Canadian phlogopite was noticed by G. Rose,[2] as early as 1862. He attributed it to the intergrowth of foreign crystals, but did not suggest what might be their nature. Lacroix[3] treated some of the Templeton mineral with hydrochloric acid and examined the residue. It was found to consist of little hemimorphic crystals of rutile elongated in the direction of the vertical axis.——In his examination of basaltic glass from Rossberg, Kroustschoff[4] discovered a pyroxene of a slightly different type from any heretofore described. The new type is transparent and of a very light green color. The crystals are prismatically developed, and show the forms $\infty P\overline{\infty}$, $\infty P\breve{\infty}$, ∞P and O P. Very frequently several individuals are united by their clino-pinacoids, sometimes by their prismatic faces. An analysis of the isolated crystals gave:

SiO_2	Al_2O_3	Fe_2O_3	FeO	CaO	MgO	Na^2O	K^2O
49.18	2.15	4.96	9.04	20.30	13.07	1.89	0.30

——Harringtonite from Ireland has been examined microscopically.[5] In polarized light it is resolved into an isotropic mass, in which crystals belonging to two distinct species of minerals can be detected. One occurs in little fibrous needles, with longitudinal extinction and negative refraction; the other is in little fragments with broken outlines. The former have the optical properties of mesotype, but are negative. The latter are probably mesotype. Since zeolites are known to have been produced by the action of warm waters, Lacroix thinks that Harringtonite might be looked upon as a gelatinous mass, which has caught up little fragments of the minerals that were floating about in the water in which it was formed. At any rate it can no longer be considered a distinct mineral.

NEW BOOKS.—The second edition of Rosenbusch's "Mikroskopische Physiographie der petrographisch wichtigen Mineralien,"[6] has recently appeared. This standard work is so very well known that the mere mention of the fact of its revision is sufficient for the purposes of these notes. The advances in the methods of microscopical petrography, the improvements in ap-

[1] Bulletin de la Société Minéralogique de France. VIII, p. 62.
[2] Monatsb. der Berliner Akad. der Wissens., 1862, p. 614; and 1869, p. 344.
[3] Bulletin de la Société Minéralogique de France, VIII, p. 99.
[4] Ib., VIII, p. 85.
[5] Lacroix, ib., VIII, p. 96.
[6] E. Schweizerbart'sche Verlagshandlung (E. Koch). Stuttgart, 1885.

paratus and the very large increase in the amount of literature on the subject within the last twelve years made a second edition of this indispensable book almost imperative. The new edition contains, in addition to a large amount of new matter in the general and special parts, a Newton's scale of prismatic colors (to which reference is made in describing the polarization colors of the different minerals), a practically complete table of petrographical literature and twenty-six photographic plates of mineral and rock sections.——Kalkowsky's "Elemente der Lithologie"[1] is a little treatise of three hundred and sixteen pages, in which the study of rocks is treated as a branch of general geology and not as an appendix to mineralogy. It is intended primarily as an introduction to inorganic geology. In the general part considerable attention is given to the structure, origin and metamorphism of rock masses. In the special part a classification of rocks is attempted, based on the origin of the material of which they are composed. Those whose material was obtained from below are classed as anogenous, those which obtained it from above are called katogenous. Among the latter class belong the sedimentary rocks and the crystalline schists, among which the author places the gabbros and peridotites. Despite the somewhat peculiar views expressed on certain subjects, the book will prove a valuable addition to the library of the lithologist, and a great aid to the student who wishes to study rocks from a geological standpoint.

BOTANY.[2]

THE ADVENTITIOUS INFLORESCENCE OF CUSCUTA GLOMERATA KNOWN TO THE GERMANS.—At the Philadelphia meeting of the American Association for the Advancement of Science, the writer presented a short paper, calling attention to the adventitious inflorescence of *Cuscuta glomerata*. The fact was supposed to be new to science, as it certainly was to the writer, and, moreover, appeared to be to the botanists of the meeting. Additional facts were presented to the Ann Arbor meeting of the Association, and in the discussion the originality of the discovery was not questioned and apparently not doubted by any one.

Imagine my chagrin a few days ago (Dec. 30, 1885), when in running over the text of Dodel-Port's Anatomisch-physiologischen Atlas der Botanik, I found the whole matter fully and accurately described. This atlas was published from 1878 to 1883, in Esslingen. The study of *Cuscuta glomerata* was made in the Botanic Gardens of Zurich, where for ten years or more it has become acclimatized.

On page 4 of part XXX, of the text to the atlas, Dr. Dodel-Port, after describing the normal branching, remarks in substance as

[1] Carl Winter, Heidelberg, 1886.

[2] Edited by Professor CHARLES E. BESSEY, Lincoln, Nebraska.

follows, viz: "Besides this normal branching there is a copious formation of adventitious shoots. These are formed endogenously upon the best nourished parts of the Cuscuta stem, and also upon the parts which bear the haustoria, where the host-plant and parasite are in immediate contact. The rudimentary shoot-buds are formed beneath the cortex of the Cuscuta stem, and break through in a manner similar to the lateral roots of vascular plants. They develop either into inflorescences, or upon injury to the rest of the plant, into vegetation shoots."

These adventitious branches were also noticed, very briefly and somewhat vaguely, by Solms-Laubach in a paper on Parasitic Phanerogams in Pringsheim's Jahrbuch für wissenchaftliche Botanik, vol. VI, 1868.—*Charles E. Bessey.*

SYMBIOSIS BETWEEN A FUNGUS AND THE ROOTS OF FLOWERING PLANTS.—In investigating the structure of the vegetative organs of *Monotropa hypopitys*, M. F. Kamienski (Mem. de la Soc. Nationale des Sciences Naturelles de Cherbourg) came to the conclusion that it is not a parasite, the most careful observation failing to detect any haustoria or other parasitic union with the root of any host. On the other hand he found the root of the Monotropa to be completely covered by the mycelium of fungus which branches abundantly and forms a pseudo-parenchymatous envelope, often two or three times the thickness of the epidermis, and especially well-developed at the apex of the root. This fungus, the species of which M. Kamienski was unable to determine, is entirely superficial, not penetrating into the living cells, though occasionally forcing its way between those of the epidermis. He contends that the Monotropa derives its nutriment from the soil entirely through the medium of this fungus-mycelium. The only parts of the root which are in actual contact with the soil are composed of lifeless cells with no power of deriving nutriment from it. The connection of the fungus with the roots of the Monotropa is not one of parasitism, but of true symbiosis, each of the two organisms deriving support and nutriment from the other.

More recently Dr. B. Frank and M. Woronin (Bericht Deutsch. Bot. Gesellschaft) have made similar observations of the mode of nutrition of Cupuliferæ and Coniferæ. Dr. Frank finds the roots of our native oaks, beeches, hornbeams, chestnuts and hazels to be covered by a dense cortex, to which he gives the name Mycorhiza, organically associated with them in growth, and composed entirely of fungus-hyphæ, completely enveloping the whole of the root, even the growing point. The structure of this cortex is that of a sclerotium; it is composed of a dense mass of hyphæ, varying in diameter from 2 to 10^{mm}, usually in several layers, from which other endophytic hyphæ penetrate into the root between the epidermal cells, which are still slenderer than those of the envelope.

By this structure the formation of root-hairs by the tree is entirely prevented, and it is through it alone that it is able to absorb nutriment out of the soil. It makes its appearance first on the lateral roots of the young seedling, and is constantly being replaced by fresh formations on older roots. Dr. Frank found this structure invariably on every root examined of trees belonging to the Cupuliferæ, also occasionally on Salicaceæ and Coniferæ, but never on woody plants belonging to other natural orders, nor on any herbaceous plant. It is quite independent of the nature of the soil. He also regards the phenomenon as an example of symbiosis, comparable in all essential points to that of lichens, the Mycorhiza corresponding to the fungal element in the lichen, the tree itself to the algal gonidia.

Dr. Woronin confirms these statements in relation to Coniferæ, Salicaceæ, and some other trees, and thinks it probable that the fungus, which he regards rather as truly parasitic, is a Boletus.—*A. W. Bennett.*

Internal Spore-Formation in Diatoms.—Count Abbé F. Castracane describes (Accad. Pontif. de' Nuovi Lincei) a remarkable appearance in a deposit of marine diatoms of Pliocene date from the Apennines. In a specimen of *Coscinodiscus punctulatus* he observed that the lower part of the valve, minutely punctuated in radial disposition, showed small uniform round stalked bodies; drawings under the camera lucida showed clearly their circular figure. No other interpretation of these minute round bodies, always found in the interior of the frustule, seems possible, except that they constitute a nest of embryonal diatoms on the point of escaping from the mother-cell. This is in accord with previous observations of the author on similar round bodies seen on the point of escaping from a Podosphenia, and with observations of Rabenhorst and O'Meara. The fact that the diatoms in which these bodies were observed had previously been treated with boiling sulphuric acid with addition of potassium chloride, shows conclusively that the round bodies seen to escape from living diatoms are not Infusoria or other organisms fortuitously collected round them, and demonstrates at the same time that, from the first moment of their existence, diatoms must be provided with a siliceous coating, though it may be of extreme tenuity. It would seem from these observations that diatom may assume the function of a sporangium, producing in its interior embryonal forms by which the species is reproduced, and which ultimately acquire the form and approximately the size of the mother-frustule.

In connection with this subject, Mr. F. Kitton states (Jour. Quekett Micros. Club) that he found on carafes of water a film composed entirely of frustules of *Achnanthes linearis;* but on filtering the water, these were never found on the filter-paper, and when the filter-paper was boiled in decarbonized sulphuric acid,

the residue showed no indication of carbonaceous remains. In the course of a few days a film again began to appear on the filtered water, which was found to consist entirely of the same diatoms. A control experiment showed that none of these diatoms, though exceedingly minute, would pass through the filter-paper employed, and the conclusion seems inevitable that the diatoms must have passed through in the form of microspores.—*A. W Bennett.*

BOTANICAL LABORATORIES IN THE UNITED STATES.—In a most instructive paper in the December number of the *Botanical Gazette*, Mr. Arthur gives descriptions of some of the more important botanical laboratories in this country. Those noticed are the following:

1. *Harvard University.* (*a*) The laboratory in connection with the Botanic Gardens. (*b*) The laboratory of Cryptogamic Botany in the Agassiz museum. (*c*) The laboratory of phanerogamic botany in Harvard Hall. Twenty-one compound microscopes are supplied to these.
2. *Cornell University.* (*a*) The laboratory for analytical and general phanerogamic work with eleven dissecting microscopes. (*b*) The microscopical laboratory and conservatory, supplied with twelve compound microscopes.
3. *University of Pennsylvania.* (*a*) Laboratory for junior work, containing an outfit of dissecting microscopes. (*b*) Laboratory for senior work. These contain twenty-four compound microscopes.
4. *Illinois University.* Laboratory and green-houses, supplied with twenty-one compound microscopes.
5. *Michigan Agricultural College.* Laboratory and conservatory, supplied with twenty-seven compound microscopes.
6. *University of Michigan.* (*a*) Microscopical laboratory, with forty-three microscopes. (*b*) The botanical laboratory proper, with six microscopes.
7. *Iowa Agricultural College.* Laboratory supplied with twenty-one compound microscopes.
8. *Wabash College.* (*a*) Laboratory for elementary botany, with an outfit of dissecting microscopes. (*b*) Laboratory for advanced botany, supplied with twenty compound microscopes.
9. *Perdue University.* Laboratory supplied with twenty-five compound microscopes and an equal number of dissecting microscopes.
10. *University of Wisconsin.* (*a*) Laboratory for elementary work, supplied with eleven dissecting microscopes. (*b*) Laboratory for advanced work, supplied with twenty-five compound microscopes.
11. *University of Nebraska.* Laboratory supplied with twenty-five dissecting microscopes, and thirty-six Coddington hand-lenses, for elementary work; and twenty-two compound microscopes for advanced work.
12. *The Shaw School of Botany.* Laboratory supplied with sixteen dissecting microscopes for elementary work, and four compound microscopes for advanced work.

LINHART'S UNGARNS PILZE, CENTURY IV.—This important distribution of Fungi deserves mention again, both on account of the beauty of the specimens and the low price at which they are furnished. The century before us contains thirty-six species of Uredineæ, three of the Ustilagineæ, six of Peronosporeæ, three of Erysipheæ, etc., etc. Good plates are given of fifteen species, and in these the microscopical details of structure are quite satisfactorily worked out. When these plates are mounted upon the same herbarium sheets as the specimens which they illustrate, they will prove very useful and instructive, especially to the beginner in Fungology.

BOTANICAL NEWS.—The "Laboratory number" (Dec.) of the *Botanical Gazette* is one of the most valuable issued during the past year. The special laboratory topics are, Some botanical laboratories of the United States; Laboratory appliances; The laboratory at Strasburg; Laboratory courses of instruction; Section cutting, besides a dozen or so general notes devoted to some phase of the subject.——A late number of *Flora* contains a paper on the infloresence of Typha, by Celakoosky.——No. 141 of the Journal of the Linnean Society contains: (1) Contributions to the Flora of the Peruvian Andes, with remarks on the history and origin of the Andean Flora, by John Ball; (2) Contributions to South-African botany, by H. Bolus and N. E. Brown; (3) A contribution to the study of the relative effects of different parts of the solar spectrum on the transpiration of plants, by George Henslow.——The December *Torrey Bulletin* contains the summary of another year's work upon the fresh-water Algæ of the United States, by Francis Wolle. Several new species are described, viz: *Ectocarpus rivularis* (Florida), *Œdogonium cataractum* (Florida), *Dictyosphærium hitchcockii* (N. J.), *Zygnema purpurea* (N. J. and Fla.), *Mesocarpus crassus* (Fla.), *Staurastrum tokopekaligense* (Fla.), besides a number of varieties. A plate of Desmids accompanies the paper. ——The *Gardeners' Monthly*, while not professing to be a botanical journal, contains much of value and interest to the botanist. Thus in the January number we find papers on the following subjects, viz: A new pitcher-plant (*Sarracenia courtii*), The so-called hardy Catalpa, Large sassafras trees, *Amaryllis treatæ*, The mistletoe in different localities, besides many notes and notelets.—— Gerald McCarthy, of Kendall Green, Washington, D.C., announces a distribution of plants of Eastern North Carolina, including 340 species at $21.——For those intending to buy botanical works we are doing a good service when we call attention to John Wheldon's botanical catalogues (58 Great Queen street, London, W. C., Eng.).——The Index to the twenty-third volume of the *Journal of Botany*, just closed, enumerates an unusually great amount of valuable matter. Among the contributors are the well known names of J. G. Baker, A. W. Bennett, M. C. Cooke, J. M. Crombie, W. B. and H. Groves, W. B. Hensley, M. T. Masters, F. von Mueller, Henry Trimen, etc.——One of the pleasant features of the past few months has been the attention given in so many journals to notices of Dr. Gray. The latest of these which we have is a neat paper reprinted from the *Sun* newspaper of Jan. 3, and entitled "Asa Gray." It is from the hand of Professor C. S. Sargent, and gives a summary of the life and labors of the eminent botanist. Very like the foregoing is the paper in the January *Botanical Gazette*, by Professor C. R. Barnes. In this paper, however, we have more of the personal history. It is accompanied by a fine heliotype.

ENTOMOLOGY.

WITLACZIL ON PSYLLIDÆ.[1]—In 1883 Dr. Witlaczil published his researches on the anatomy of the Aphides, and in 1884 on their embryology (of which paper we gave an abstract in AMERICAN NATURALIST, Feb., 1885). He now furnishes an additional contribution to the anatomy of the Phytophthira, or plant-lice, making the small group of Psyllidæ the subject of important researches; his exposition of the structure of the insect brain being of exceptional value. The species examined by him represented the genera Psyllopsis, Rhinocola, Psylla, Homotoma, Trioza. His methods were teasing in saline solutions, treating with dilute acetic acid the fresh and stained animals entire and making sections in the Naples way with Jung's microtome.

In external appearance the Psyllidæ are small (about a millimeter in length) differing from other families of Homoptera by the similarity of both sexes, which are winged and are provided with a pair of compound eyes and three simple ocelli, and have ten jointed antennæ, the two joints next the base short and thick, and the terminal joint bearing a pair of bristles. During life the antennæ are constantly vibrating. Figs. 1, 2 show the male,

Fig. 1.

Fig. 2.

FIG. 1.[2]—Psyllopsis, ♂, dorsal view, right wings removed. FIG. 2.—The same, lateral view, wings removed.

[1] Die Anatomie der Psylliden, von Dr. Emanuel Witlaczil in Wien. Zeitschrift für Wissenschaftliche Zoologie, Vol. XLII (1885), pp. 560–658, and pl. XX–XXI.

[2] *Explanation of reference-letters in the figures.*—*a*, anus; *al*, antennal lobe; *an*, abdominal nerve; *at*, antenna; *ats*, antennal swelling; *cb*, central body of brain; *cp*, crop; *es*, eye swelling; *ga*, ganglion, *gz*, genital hooks; *h.in*, hind-intestine; *id*, inner decussation; *ln*, limb nerve; *mb*, mushroom body; *Mg.v.* malpighian vessels; *m.in*, mid-intestine; *ml*, mid-lobe of brain; *oc*, compound eye; *ocl*, ocellus; *od*, outer decussation; *oes*, œsophagus; *om*, outer medullary layer; *pe*, penis; *rc*, rectum; *s.oe*, sub-œsophageal ganglion; *st*, stomach; *vn*, ventral nerve-cord. Roman numerals indicate thoracic somites and Arabic numerals abdominal somites.

whose abdomen is slightly compressed. The abdomen of the female is rounded. The wings of these insects and of the winged forms of Aphides are used chiefly as parachutes. The coxæ of the limbs coalesce with the thorax, and the tarsi are two-jointed, bearing a pair of terminal claws. The hind-limbs are specialized for springing. The first abdominal somite of both sexes is added to the metathorax to enlarge the springing-gear; the second abdominal somite forms a short stalk for the abdomen, and the terminal abdominal somites are so modified as to have misled the systematists. In the male the tenth somite seems to be inserted on the eighth, as the ninth has only its ventral part developed and ends the abdomen, whilst the tenth, bearing the anus and penis, is reverted dorsad. In the female the ninth somite is discernible only by its appendages, and the tenth is a roofing dorsal plate (the upper genital dorsal plate of Löw) bearing in its center the anus fringed by wax-glands. Thus in both sexes the typical number of ten somites can be found.

The circum-anal wax-glands are in the larvæ of both sexes; and wax-glands producing wax-fibrils are present on other parts. Wax-particles sometimes cover the larvæ, protecting the back from excrementitious matter. Some larvæ (Psyllopsis) have spear-shaped wax-hairs; the larva of Trioza has a marginal row of leaf-like wax-plates. All the wax-hairs arise like chitinous hairs from large hypodermal cells, which have vacuoles presumably filled with the secretion-fluid.

The stigmas of the tracheal system are denticulated on each side, and have a self-acting closing apparatus (not as described by Landois). They have a short muscle on the ventral side, so connected with the dorso-ventral muscles of the body that on the contraction of these muscles the stigmatic muscle contracts and opens the valve. This is probably for expiration. Inspiration is effected by the mere elasticity of the tracheæ, and the stigmatic valve closes by its own elasticity. The will of the insect does not control these movements.

The *nervous-system* and *sense-organs* are here treated relatively to insects in general, and much new light is cast on the subject of the insect's psychology. The brain of the Psyllidæ is rather large, having a middle lobe and two lateral lobes, the latter sending off the optic nerves (Figs. 3, 4).

The median lobe is prolonged downwards into the procephalon.[1] Its posterior part becomes the two commissures leading to the subœsophageal ganglion, from which the mouth-organs are innervated. The ventral nerve-cord has four ganglia, three for the limbs and a fourth for the abdomen whose ganglia are fused into a single mass. The brain-mass is much as in other insects, having a central medullary system and a peripheral layer of a cortex

[1] Thus I render Vorderkopf; "procephalic-lobes" is inaccurate, as the part is not paired; the term "forehead" is preoccupied.—*G. M.*

of ganglion-cells which fails only at its posterior part. The ganglion-cells are polygonal or roundish, varying in size; they have a horny nucleus, and become stained whilst the medullary part remains clear.

The *compound eyes* are well described by Viallanes (Ann. des Sci. Naturelles, 1882) for Musca. In Psyllidæ they are somewhat simpler, having (1) at the surface numerous separate lenses of the cornea, slightly biconvex, (2) below them a layer of crystalline cones, often brownish, (3) next comes a dark layer of rhabdites forming the retina; each rhabdite being a slender truncated cone, narrowing inwards. The whole system of rhabdites converges towards the center of the eye, whence nerves run towards the brain. The subsequent layers of Viallanes (post-retinal fibers, ganglion cell-layer, palisade-layer and chaplet-cells) cannot be clearly recognized in Psyllidæ. The retinal fibers pass by the

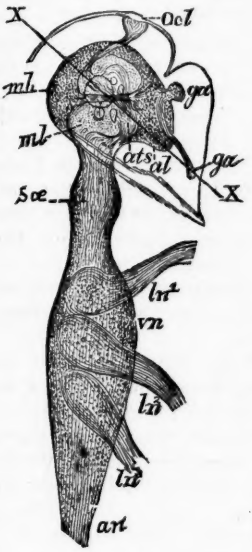


Fig. 3.

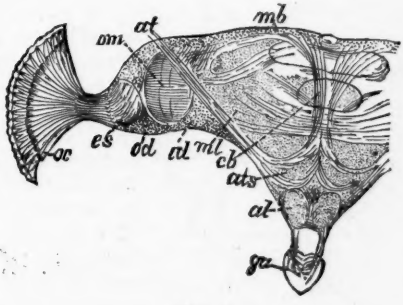


Fig. 4.

FIG. 3.—Nervous system of Psylla. FIG. 4.—Transverse section of brain of Psylla, along line X X of Fig. 3.

ganglion cell-layer into the "eye-swelling" (*es* of Fig. 4) (the optic ganglion of Viallanes), an enlargement of the medullary substance. The fibers passing this way toward the median brain-mass form an "outer decussation" (*od*). Some fibers from this decussation go to the adjoining cortex, some to the outer part of the medullary layer, some pierce this so as to reach the inner decussation (*id*), and some proceed thence across the brain so as to form a chiasma with fibers from the opposite eye. Some fibers from the eyes and some from the other outer lobes of the brain find their way to the *central body* (Fig. 4, *cb*) in the mid-lobe, and nerves may be traced from all these lobes and from the central

body to the anterior cortex of the brain with its abundant ganglion-cells.[1]

The *simple eyes* have biconvex lenses and rhabdites joined to nerve fibers, which run back to the infero-posterior region of the brain, and thence advance so as to enter the central body. The antennal nerves run straight back to the antennal lobes (*al*), whence some fibers run forwards to the central region of the brain.

The "central body" has been described by investigators as a fan-shaped organ. Packard,[2] after Newton, described it as a half-moon-shaped body, concave backwards and separated by a network of fibers from the brain, and supposed it to consist of modified cells. In Psyllidæ it is bean-shaped, consisting of granulated matter not at all isolated from the surrounding parts of the brain, but receiving fibers from and sending fibers to the other lobes, and is nothing more than a central commissural system, its cell-like elements being the cross-sections of fibrous masses.

The *mushroom-bodies*, described by authors, are found in Psyllidæ only in a rudimentary form, being some thick masses of ganglion-cells in the upper anterior border near the median line, whence bundles of fibers run backwards.

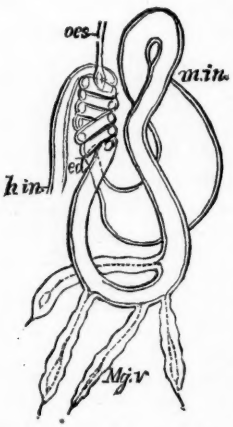


FIG. 6.—Digestive tract of Psyllopsis.

Taken as a whole the brain, with its connections with procephalic ganglion-masses, subœsophageal commissures and ventral nerve-cord, and various lobes in its own mass, is complex; and it is scarcely possible to join sections made in different directions into a unity, so as to get its real structure. As a whole its inner part is a central nerve system consisting of fibrous masses, which on the one side end in a sense-organ or in a peripheric nerve, and on the other in a cortical layer of the brain, entering its ganglion-cells. The insect-brain is, therefore, a projection-centrum, the mushroom-body being special. The most important nerves entering the brain (as from the eyes, antennæ, limbs) cause a swelling in its medulla, where the fibers are deflected so as to change their course.

Digestive tract.—The mandibles and first maxillæ are developed

[1] S. J. Hickson (in Quarterly Journal of Microscopical Science, April, 1885) uses the terms *opticon*, *epiopticon* and *periopticon* for three medullary masses belonging to the eye of Musca; representing respectively *om*, *es*, and a tract near *oc* of our Fig. 4.—*G. M.*

[2] Second report U. S. Entomol. Commission, 1878–9. The literature of the subject is there given.

into "retort-shaped organs," and the second maxillæ form a short under lip which is inserted on the short prothorax. The piercing stylets are very long, lying in a groove of the under lip, and at their base forming loops which are enclosed in a dermal sac. This is the structure also in Coccidæ, as Dujardin and Mark shew [and is well seen in the larval seventeen-year Cicada.—*G.M.*]. The œsophagus is narrow, extending as far as the abdomen, where the stomach and beginning of the mid-intestine coalesce with the hind-intestine (Fig. 5), the two parts winding round each other in several turns. This coalescence is caused by the contraction of the mid-intestine. Mark shews that in Coccidæ the arrangement is different, the end of the œsophagus and beginning of the stomach having a small winding loop which is received into a sac formed by the hind-intestine. This latter is also the way in Cicadidæ. The malpighian vessels are four, short and distinct, their ends running into a suspensory ligament. They are wanting in Aphides and Chermetidæ.—*G. Macloskie.*

Entomological News.—A paper by Dr. E. Witlaczil, on the morphology and anatomy of the bark lice (Coccidæ) appears in Zeitschrift für Wissens., Zoologie, issued Dec. 31, 1885.——Dr. R. von Limbeck has investigated (Litzungsber, K. Akad. Wissenschaften, Wien, 91, 1885, p. 322) the histology of the yellowish-brown and white muscles of insects; the former are thoracic and belong to the wings, the latter are abdominal muscles, and largely form those moving the hind limbs.——According to *Science* for Jan. 15, the city of Mexico has for a number of months past been afflicted with a scourge of mosquitoes, which have abounded so as to cause sickness, and, it is said death, by their poisonous bites——The grand prize in anatomy and zoölogy of the French Academy has been given to Dr. J. Chatin for a work, as yet unpublished, on the tactile organs of insects and Crustacea.——The Transactions of the Entomological Society of London, Dec. 2, 1885, contain an interesting life-history of a trap-door spider (*Atypus piceus*), by F. Enock; also an essay on the classification of the Australian Pyralidina, by E. Meyrick. He divides the group into thirteen families, and estimates the number of described species throughout the world at 2500. He thinks that the Phycidæ may be regarded as a development of the Galleriadæ, the Botydidæ of the Scopariadæ, and the Hydrocampidæ and Musotimidæ of the Pyralididæ. * * * The Tineodidæ (formed for the reception of the genus Tineodes), Oxychirotidæ, Pterophoridæ, and Alucitidæ on relics of a once more extensive section of the group, now reduced to a fragmentary condition, and approaching most nearly to the Crambidæ and Scopariadæ."

ZOÖLOGY

THE PROATLAS, ATLAS AND AXIS OF THE CROCODILIA.—I. *Proatlas.*—In all Crocodilia there is developed an osseous piece between the skull and the neurapophysis of the atlas. This piece is called "kleines niedriges Bogenstück" (Meckel[1]); "lame transverse" (Cuvier[2]); "oberes Schluss-Stück" (Stannius[3]); "oberer Bogen" (Bruch[4]); "Spinal — oder Dachstück" (Brühl[5]); "neural spine of the atlas" (Owen[6]); "proatlas" (Albrecht[7]); "postoccipital bones" (Marsh[8]).

Bruch (l. c., 1861) was the first to give the correct explanation of this piece, he *considers it as the neurapophysis of a vertebra, between the skull and the atlas.*

In 1880 Albrecht[9] reached the same result (l. c.).

Brühl and Marsh consider the elements in question as belonging to the skull: Dollo[10] has shown in extenso that this view is wrong, and that the "postoccipital bones" really represent the "proatlas" of Albrecht, and therefore parts of the vertebral column.

Eudes-Deslongchamps[11] says that it "représente l'arc postérieur de l'atlas chez l'homme."

Dollo (l. c.) has given a list of vertebrates in which the "proatlas" has been observed; it is not necessary to repeat it.

I have to add only some few points:

1. The proatlas is developed from two different cartilages exactly in the same way as all neurapophyses.

2. The two parts may be distinct in the young animals, and even in adult ones.[12] In a nearly ripe embryo of *Jacare vallifrons* I find two elongated osseous elements. In a young *Alligator*

[1] Meckel, J. F. System der vergleichenden Anatomie, 2 ter Theil. Abth. 1, Halle, 1824, p. 430.

[2] Cuvier, G. Recherches sur les ossemens fossiles, Quatr. éd., Tome IX, pp. 192–193, Paris, 1836.

[3] Stannius, H. Lehrbuch der vergleichenden Anatomie der Wirbelthiere, Berlin, 1846, p. 134.

[4] Bruch, C. Vergleichende Osteologie des Rheinlachses, Mainz, 1861, p. 134.

[5] Brühl, C. B. Icones ad zootomiam illustrandam, Das Skelet der Krocodilinen, Wien, 1862, pp. 2–3.

[6] Owen, R. On the anatomy of Vertebrates, Vol. 1, p. 65, London, 1866.

[7] Albrecht, P. Ueber den Proatlas, einen zwichen dem Occipitale und dem Atlas der amnioten Wirbelthiere gelegenen Wirbel, Zool. Anzeiger, 1880, p. 475.

[8] Marsh, O. C. Principal characters of American Jurassic Dinosaurs, Part VI. Restoration of Brontosaurus, Am. J. Sc., Vol. XXVI, Aug., 1883, pp. 82–83.

[9] It is generally believed that Albrecht first showed the true nature of these bones, but, as I have said, Bruch already had the same idea nearly twenty years before Albrecht.

[10] Dollo, L. Cinquieme note sur les Dinosauriens de Bernissart, Bull. Musée Roy. Hist. Nat. Belg., Tome III, 1884, pp. 129–135.

[11] Eudes-Deslongchamps. Mémoires sur les Téléosauricus de l'époque jurassique du département du Calvados. Mém. Soc. Linn. Normandie, Vol. XII, Caen, 1863, p. 43.

[12] Huxley, T. H. A manual of the anatomy of vertebrated animals. London, 1871, p. 251.

mississippiensis the bones are separate but not elongated as in Jacare. Usually the two elements unite early in the embryo.

3. It is possible that a proatlas existed in Rhynchosaurus Owen, a reptile very nearly allied to Sphenodon (Hatteria). Sphenodon has rudiments of the proatlas, as shown by Albrecht;[1] therefore the same bones ought to be present in Rhynchosaurus; this seems to be confirmed by a note by Owen[2] on this reptile.

"A small flattened triangular plate, which adhered to the posterior part of the skull, was suspected by Dr. Ward to be a tooth; it appeared to me, from the character of the exposed surface, to have at least equal claims to be regarded a dermal scute. In preparing the mold of the cranium this part was detached and lost, a circumstance which I have much regretted, since it prevented my applying to it the test of a microscopical examination."

In his detailed description of Rhynchosaurus, Owen[3] does not mention this point.

I believe it possible that the small flattened triangular plate, "which adhered to the posterior part of the skull," represents a piece of the proatlas.

It is probable that the proatlas is present also in the Prototosauria, which have many characters common with Sphenodon.

II. *Atlas and Axis.*—The centrum of the atlas is always represented by the odontoid process of the axis, and can be separated easily in the Crocodilia. The piece below the centrum of the atlas, supporting the neural arch of that vertebra, is the *hypapophysis*, between the proatlas and the atlas.

The hypapophysis between the atlas and axis is probably coossified with the anterior and lower part of the axis-centrum, as in birds and some dinosaurs. There seems to be a great confusion in the determination of the ribs belonging to the first vertebræ in the Crocodilia, and even about the true nature of these vertebræ. Koken[4] says, 1882: "Es ist erstaunlich und befremdend, wie sehr bei diesen sonst so conservativen Thieren die Ausbildung der ersten Halswirbel, und zwar in wesentlichen Punkten, differirt. Vorläufig erscheint es unmöglich, in Art und Reihenfolge der Veräenderungen eine Gesetzmässigkeit zu bringen."

This is very strange indeed. We find it very much more "befremdend," that Koken says (p. 808), that an alligator (*A.*

[1] Albrecht, P. Note sur la présence d'un rudiment de proatlas sur un exemplaire de *Hatteria punctata* Gray. Bull. Mus. Roy. Hist. Nat. Belg., T. II, 1883, p. 190.

[2] Owen, R. Report Brit. Fossils, Rept. II; Brit. Assoc. Rep., 1841, p. 150.

[3] Owen, R. Description of an extinct lacertilian reptile (*Rhynchosaurus articeps* Owen) of which the bones and footprints characterize the upper new Red sandstone at Grinsill, near Shrewsbury. Cambr. Philos. Soc. Trans., VII, 1842, pp. 354–369.

[4] Koken, E. Die Reptilien der norddeutschen unteren Kreide. Zeitschrift Deutsch. Geol. Gesellsch. Jahrg, 1883, p. 808.

darwini) and a crocodile (*C. ebertsi*) *have no hypapophysis*, following Ludwig's[1] wrong description.

All reptiles possess the hypapophysis (unteres Schluss-stück) of the atlas, and it is quite injudicious that Ludwig and Koken could deny the existence of such an element in an alligator and a crocodile *from the Tertiary.*

The matter is very simple. Ludwig described the true hypapophysis of *A. darwini* as the centrum of the atlas; the axis centrum + the odontoid process as the centrum of the axis. Ludwig says that the odontoid process of the axis is wanting in *C. ebertsi*, but he describes it. He makes something very remarkable out of its separation from the axis. He did not find the hypophysis, and therefore he says this element is wanting.

There is no doubt whatever that the atlas and axis of Alligator darwini and Crocodilus ebertsi possessed the same structure as the living alligators and crocodiles.

Koken finds similar difficulties in the articulation of the ribs (p. 809). "Die zum Epistropheus gehörige Rippe ist bei den lebenden Crocodilinen gegabelt und gelenkt (nur mit dem Capitulum) zwischen Epistropheus und Dens Epistrophei, mehr am lezteren.

"Bei *Crocodilus ebertsi* ist sie ganz auf den Atlas-Körper übergegangen, bei *Alligator darwini* trägt degegen der Epistropheus die Rippe, bei beiden ist sie einfach.

"Bei Enaliosuchus setzt sich die einfache Rippe an die Diapophyse des Epistropheus, während die Parapophysen keine Rippen stützen.

"Bei Teleosaurus ist sie gegabelt und sowohl an Diapophyse wie Parapophyse inserirt.

"Bei Teleosaurus findet sich ferner ein drittes Rippenpaar, welches intervertebral zwischen Atlas-Körper und Epistropheus articulirt."

If these characters are true, we have to abandon the value of morphology. But we hope to show that the above statements are wrong or incorrect.

1. In the living crocodiles the rib of the axis shows the following conditions:

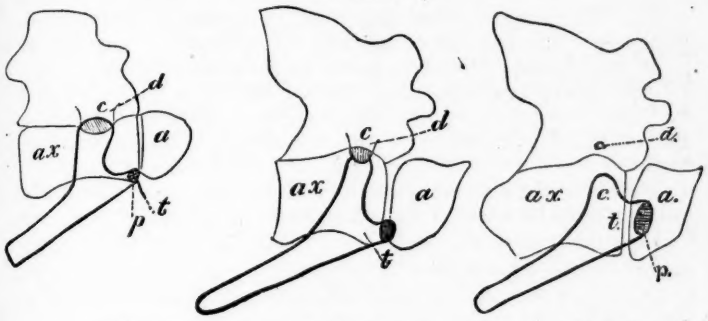
In *Gavialis gangeticus* the capitulum of the axis-rib articulates only with the centrum of the atlas. There is developed a rudimentary diapophysis in the neural arch of both sides. The tuberculum of the axis rib does not reach that diapophysis, but is probably connected with it by ligament.

In an adult *Alligator mississippiensis* the capitulum articulates

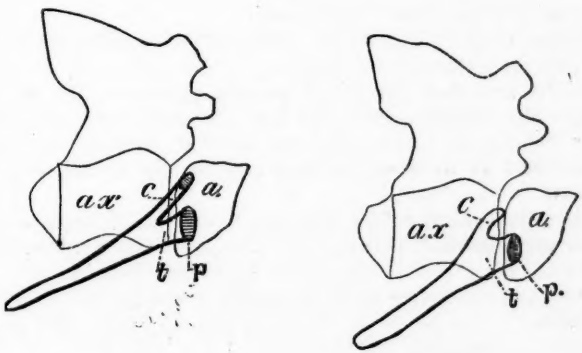
[1] Ludwig, R. Fossile Crocodiliden aus der Tertiaerformation des Mainzer Becken, Palaeontographica. Suppl. III, Lief. 4 u. 5, Cassel, 1877, pp. 13–14, p. 37.

with the atlas-center and by a *very small* face with the axis-center also. There is no trace of a diapophysis. The tuberculum does not reach either the axis or the atlas, but is connected with the *atlas* by ligament.

SCHEMATIC FIGURES, SHOWING THE RELATION OF THE AXIS-RIB TO ATLAS AND AXIS.



Teleosaur. Enaliosuchus. Gavial.



Alligator, young. Crocodilus.

a, atlas-centrum; *ax*, axis-centrum; *d*, diapophysis; *p*, parapophysis; *c*, capitulum; *t*, tuberculum.

In a very young *A. mississippiensis* the tuberculum is complete, and articulates with the atlas-center; the *capitulum* articulates with the same bone.

In *Crocodilus americanus* Schneid., the capitulum articulates with the atlas-center, the tuberculum touches the neurapophysis of the axis, but there is no face on that bone.

2. *Crocodilus ebertsi* shows the same conditions as *A. mississippiensis.*

In *Alligator darwini* the axis-rib is connected with the atlas-center. Ludwig, considering the atlas + axis as the axis, says that it articulates with the axis.

3. In the Enaliosuchus-axis a diapophysis is present. Koken believes that Enaliosuchus has a simple rib connected with this diapophysis. This can not be correct; if the diapophysis is present there must be an articulation for the tuberculum of the rib. The tuberculum never disappears before the capitulum. I believe that in Enaliosuchus (if it really belongs to the Crocodilia) a complete rib was developed in the axis, the capitulum articulating with the well-developed diapophysis, the tuberculum with the axis-centrum or with both the axis and atlas, or with the atlas alone. This face will probably be found if the atlas-rib is removed.

4. In the Teleosaurus-axis the diapophysis and the parapophysis are developed and the ribs two-headed.

Deslongchamps describes an additional rib connected with the atlas-center, but he figures no articular surface for this rib on the atlas. It is a morphological impossibility that a rib should exist between the ribs of the atlas, connected with the hypapophysis, and that of the *axis.*

At first when I saw Deslongchamps's figures I reached the conclusion that the axis-rib had entirely disappeared in the living Crocodilia, and that the *rib in question* represents the rib connected with the atlas-center (the true atlas-rib), but since I have shown that the axis-rib has not disappeared in the living Crocodilia, but is shifted in front of the axis successively, I must abandon this view.

Koken believes that the additional "rib" in Teleosaurus represents the tubercular part of the atlas-rib. This may be, but it is *not* probable. If the atlas and axis of the Parasuchia (Belodon, Stagonolepis) are known, we probably will get more light on this point.

I give the following results:

All crocodiles possess a hypapophysis (unteres Schluss-stück) of the atlas.

All crocodiles possess ribs of the atlas and ribs of the axis.

In the older crocodiles (Teleosaurus) the axis-rib has a well developed capitulum and tuberculum, the latter articulating with a well-devloped diapophysis. A similar condition is shown in Enaliosuchus from the Lower Cretaceous.

Later the diapophysis, and with it the capitulum, get rudimentary, the axis-rib loses its articulation with the axis and is shifted to the atlas.

This process is shown by the following diagram (relation of the axis-rib to the atlas and axis):

	Capitulum.	*Tuberculum.*	*Diapophysis.*	*"Parapophys."*
Teleosaurus.	articulating with "parapoph." of axis. (hypapophysis)	articulating with diapophysis	well developed	present on the anterior and lower part of axis (hypapophysis)
Enaliosuchus.	"	"	"	on the axis or atlas, or between them
Gav. gang.	articulating with "parapophysis"	rudimentary, connected by ligament with the rudim. diap.	rudimentary	present on the atlas-center
Allig. mississ. and other croc.	articulating with "parapophysis"	rudimentary, connected by ligament with the atlas or axis, if present connected with atlas	wanting	present on the atlas center, partially on the axis

—*Dr. G. Baur, Yale College Museum, New Haven, Conn, Jan. 7, 1886.*

THREE PROBLEMATICAL GENERA OF MEXICAN BOÆFORM SNAKES. —Besides genera of typical Boidæ known to inhabit Mexico and Central America, three genera have been found whose position has been more or less uncertain. These are Charina Gray, Lichanura Cope, and Loxocemus Cope. All of them have been referred by one or another author to a supposed family Erycidæ, the type of which is the genus Eryx of India and Africa. This family has, however, no further definition than the non-prehensile character of its tail; in all other respects its members agree with the Boidæ. This prehensile character is, however, well known to be extremely evanescent in snakes, and to have no greater than generic value, and sometimes not even that. The tail of Lichanura can hardly be assigned to the one category more than to the other.

Some years ago I referred Loxocemus to the Pythonidæ, a course which has generally been adopted by authors; while the two others have been kept in the Erycidæ, Mr. Garman having gone so far as to unite them. An examination of the skeleton,

however, shows that they all differ materially from each other, and must be referred to three separate families, viz., the Pythonidæ, the Boidæ and to the new family of the Charinidæ. The definitions of these families are as follows:

Supraorbital, postfrontal and coronoid bones present.....*Pythonidæ.*
Postorbital and coronoid bones present; no supraorbital.....*Boidæ.*
Neither postfrontal, supraorbital nor coronoid bones present.....*Charinidæ.*

—*E. D. Cope.*

NOTE ON THE PROBLEM OF SOARING BIRDS.—In the interesting paper on soaring birds, by I. Lancaster, published in Nos. 11 and 12 of the NATURALIST for 1885, the writer attributes the power which is utilized by the bird, no doubt correctly, to the condensation and expansion of the atmosphere, produced by the relative motion of the bird with respect to the atmosphere.

An evaluation, if it were practicable, of the excess of the upward, above the downward, atmospheric pressure upon the bird, when it soars horizontally or remains stationary on fixed wings, would show, no doubt, that such excess is exactly equal to the weight of the bird; and the rear expansion on a vertical section of a bird that remains stationary on fixed wing in a current of air, would be found to be exactly equal to the force exerted by the breeze. No other explanation of the phenomenon is conceivable, and this is substantially the explanation suggested by Mr. Lancaster. But he errs in his attempt to show that a bird can "soar" as a result of the action of gravity alone, without descending toward the earth, that is, without sacrificing its energy of position (potential energy). He has apparently been led into this error by a misconception of the phenomena of resultant motion, or by confounding force and motion; for he assumes that when a body is descending uniformly through the atmosphere and is therefore meeting with atmospheric resistance equal to its weight, it may, at the same time, by the action of an upward lateral force resulting from the condensation produced by its descent, have an upward lateral motion, so that its vertical ascent shall equal its vertical descent.

This is obviously a misinterpretation of the phenomena; for it is well known that the upward lateral force would arrest the downward motion, so that the *cause* of the upward motion would be immediately withdrawn; and besides, it leads to the absurd conclusion that the secondary effect of gravitation, through the condensation and expansion of air, may exceed that of its direct action.

Obviously the best the bird can do to sustain his elevation in still air, will be, by suitable position of his wings, to effect a *succession* of descents and ascents, thus utilizing, not only the condensation produced by his descent, but also the momentum acquired by his velocity.

It follows, therefore, that soaring birds utilize *two* forces, viz., gravity and the *motion* of the atmosphere, and that without atmospheric motion other than that produced by his descent, a soaring bird cannot for an instant maintain, undiminished, his energy of position.—*J. E. Hendricks, Des Moines, Iowa, Jan. 14, 1886.*

On the Types of Tooth-structure in Mammalia.—The trifid form of the lower molar of the genus Monachus and of Mesonyx is in reality repeated in the cusps of the molars of Ungulata generally. In Sus the second upper molar cusp[1] sends a long basal process forward and outward toward the canine cusp and may be said to represent the anterior cuspule of the trifid figure of the plan of cusp itself, while the posterior cuspule is aborted. The bicuspid cusp exhibits a small anterior cuspule which extends directly outward to reach the base of the canine cusp. Both the ridges formed by these cuspules are the first to become worn in mastication. This plan of arrangement is repeated in several extinct genera. among which may be mentioned Phenacodus and Hyracotherium.

In *Hyracotherium cuspidatum*[2] the cuspule is placed obliquely to the true molar cusp, precisely as in Gymnura, instead of being continuous with the cusp. The differences between the cusp and the oblique prolongation of the first molar cusp forward and inward being one of degree only.

In *Pliolophus vintanus*[3] the arrangement of the cusps appears to be exactly that of Sus. The only features which are lacking are those of the heel of the tooth and the shapes of the cusps themselves.

It may be said that the presence of ridges, especially of the oblique ridges, entering into the triturating surfaces of the tooth, relate to the survival of the small basal cuspules of the trifid figure. As may be easily supposed the direction of the ridges is subject to much variation. In man such direction is along a line which connects the first molar and the bicuspid cusps, and this arrangement appears again in Hippopotamus. In *Mastodon americanus* and Achænodon the cusps are without cuspules, which are seen only in aberrant examples of the last molars. In the former genus they have been figured by Leidy.[4]

The ridges representing the cuspules are unnamed in any regular manner by authors. They are said by Owen[5] to exist in the human tooth only. Leidy calls them the "accessory eminences," Cope[6] the "lesser tubercles," "crests," etc. They enter into the

[1] The nomenclature of the cusps proposed by me in 1874 (*Dental Cosmos*, XVI, p. 617) is here followed.
[2] Cope. Wheeler's Survey, IV, p. 267, pl. LXV, fig. 18.
[3] Ibid, pl. LXV, fig. 1.
[4] Extinct Mammalia of Dakota and Nebraska, p. 245, pl. XXVII, f. 13, 15.
[5] Odontography, p. 453.
[6] Journ. of Acad. of Nat. Sci., 1874.

"interstitial" type of tooth of Ryder.[1] They constitute in part the intermediate (median denticules) cusps of Gaudry.[2] The object of the cuspule is to support the cusp, to the base of which it is attached. Indeed, it presents the first attempt to modify the bunodont type of dentition toward the lophodont type. It is consistently maintained only when the strain of impact is of moderate amount. Should the strain become excessive the lateral border of the tooth is arched inward, as first pointed out by Ryder.[3] In the presence of these strong arches or flutings the main surfaces of attrition no longer need the basal cusp supports and they disappear. This change is illustrated in Paleosyops and Limnohyus.

When a tooth becomes worn and an island of dentine appears at the summit of the cuspule it is often seen to be obliquely placed to the main cusp. This is occasionally seen in Achænodon and Mastodon and constantly in Hippopotamus. A key is in this way afforded to interpret the islands of the complex tooth of Phacochærus. Care should be taken not to be misled in applying this method of interpretation to intricate types of tooth-structure, such as Polymastodon and its allies, for in these genera there exist true cusps only (cuspules being entirely absent), and the third row of islands (when such exists) being simply a linear row of well-defined characters placed along the border of the tooth.

A tooth that has been for a long time subjected to the action of a dilute acid is entirely deprived of its enamel, and permits the superficies of the dentine to be clearly seen. It is of interest to note that the cusps upon the dentine of a tooth thus prepared, while corresponding in a general way to those on the free enamel surface, are sufficiently distinct therefrom to afford material for comparisons, and to suggest relationships of a different character from those determined by the study of the entire tooth. Thus the dentine cusps of the premolars of Sus suggest the form of the corresponding teeth in Monachus and of Mesonyx. The cusps of the third molar of Sus are strikingly like the molars of the Insectivora and of lower molars of the genus Bathyopsis. In like manner the dentinal surface of an aberrant molar tooth of man presents the essential features of teeth so remote as to recall the type seen in Centetes, Gymnura,[4] Chrysochloris, as well as in the numerous ancestral types described by Cope from the North American Eocene.[5]

A practical method of studying teeth with the object in view of

[1] Proc. of Acad. of Natural Sciences, 1878, 45.

[2] Les Enchainements du Monde Animal, Paris, 1878, 70.

[3] Loc. cit.

[4] The arrangement seen in Sus is the same essentially as in Gymnura. The minute cuspule on the crown of the first upper molar is in precisely the same position as in Sus and, indeed, answers to it in every respect in the description of Mr. Dobson except that it is not connected to the anterior inner cusp as named by that author. It is a little curious that the dental formula of Gymnura is the same as in Sus.

[5] Report U. S. Geo. Sur. of Territory, III, 1884.

determining lines of descent is thus presented. The enamel organ of generalized types it would seem furnishes groups of characters which are probably secondary in value (since the several parts of the organ indicate wide ranges of variation and of great adaptivity) to[1] those yielded by the modulations of the surfaces of the dentine.—*Harrison Allen.*

An Extraordinary Human Dentition.—A gentleman living in Charles City, Iowa, recently exhibited to me the following remarkable dentition. To name the teeth from their forms, the formula would be as follows: I. $\frac{5}{4}$; C. $\frac{1}{1}$; Pm. $\frac{2}{2}$; M. $\frac{3}{3}\frac{3}{4}$. By position the formula would read thus: I. $\frac{5}{4}$; C. $\frac{1}{1}$; Pm. right side $\frac{2}{1}$; left side, $\frac{2}{\text{mol. temp.}\ 3}$; M. $\frac{3}{3}$. The first true molars in both jaws have a small accessory lobe on the inner side of the anterior inner tubercle. A brother of this gentleman has the following dental formula: I. $\frac{4}{4}$; C. $\frac{1}{1}$; Pm. $\frac{2}{1}$; M. ^{3}. A sister presents the following: I. $\frac{3}{3}$; C. $\frac{1}{1}$; Pm. $\frac{2}{1}\frac{2}{2}$; M. $\frac{3}{3}$. A grandmother has the incisors $\frac{5}{4}$.—*E. D. Cope.*

Zoological News.—*Echinodermata.*—H. Ayers, who has studied the sphæridia of Echinoids both at Cambridge and Banyuls, asserts (Quart. Jour. Mic. Sci., Nov., 1885) that these organs have great specialization of parts, especially of the nerve-cells, and that, as before considered probable by Lovén, the evidence at present is in favor of the view that they have the combined functions of taste and smell. Sounds do not appear to affect the sphæridia in the least, while the spines and pedicellariæ are at once affected, and the adjacent spines direct themselves toward the source of sound.——During the *Talisman* expedition fifty-four species of starfish were found, some from more than 4000 meters. Thirty-five of these species are new, and afford instructive combinations of characters.

Mollusca.—Paul Pelseneer (Quart. Jour. Mic. Sci., Oct., 1885) describes the cephalic appendages of Clione, Clionopsis and Pneumodermon. From this it appears that all these genera have two pairs of tentacles, the posterior with eyes; and that Clione and Pneumodermon are also possessed of buccal appendages, which in the latter genus are provided with suckers. The tentacles are probably homologous with those of ordinary gastropods. ——Professor Ray Lankester calls attention to the fact that sixty-

[1] The more simple forms of teeth, such as those of the molar series of the peccary, show scarcely any differences between the enamel and the dentine surfaces, and it may be reasonably expected that the greatest contrasts will be seen in the teeth which present on the enamel the largest number of cuspules and cingula which bear rows of mammilations. The position of all small cusps between the four principal cusps of the bunodont molar, is either directly between the cusps or placed obliquely to them. When in the position first named they represent the highest degree of specialization attained by the molars of the carnivores, or they exhibit a tendency toward the development of the transverse ridge of the tapirodont type of tooth. When in the position last named the cuspule described above leads to the oblique crest seen in Palæotherium and its allies.

five years ago Mr. Benj. Gaillou made known the fact that the green coloring of the European oyster (*O. edulis*), is due to the fact that it feeds upon a diatom, the *Navicula ostrearia* Gaillou. This has been persistently ignored by the advocates of the copper theory, possibly because of the peculiar blue-green of the gill lamellæ, etc., of the oyster. The Navicula in question contains a blue-green pigment diffused through its protoplasm. This pigment is absorbed by the blood of the oyster from the contents of its alimentary canal, and collected by certain secretive cells which are limited to the surface of the branchiæ and the adoral face of the labial tentacles.

Arthropoda.—J. S. Kingsley contributes to the Quart. Jour. Mic. Science (Oct. 1885), some notes on the embryology of Limulus. He regards Limulus as an arachnid, but states that it takes us back to a time when the distinctions between the Crustacea and Arachnida were far less marked than now. He also describes the outlet in the embryo of the brick-red glands.——From an article in the Quart. Jour. Mic. Science, by Professor A. Sedgwick, it appears that there are two species of Peripatus, *P. capensis* and *balfouri*. The latter has eighteen pairs of fully developed legs, and is of smaller size than the better known species. The male organs of Peripatus are a couple of blind tubes, united near their termination. It does not appear that any portion can be extruded, and the spermatophores seem to be deposited upon any part, even on the head, of the female. Yet the uterus of the female, consisting of two tubes closely applied, is always full of embryos.

Fishes.—Dr. J. Beard gives, as the result of a continued study of the branchial sense organs in the Ichthyopsida (Quart. Jour. Mic. Sci., Nov. 1885), the conclusion that *at present we are acquainted with no invertebrate nervous system which is built upon the same plan as that of vertebrates.*

Birds.—Dr. Hans Gadow has examined the three species of Rhea. The long-billed appearance of *R. macrorhyncha* is due less to a larger, stronger bill than to a narrower and more slender skull. The three species have each thirty-three vertebræ from the atlas to and including the first primitive sacral vertebra, but *R. macrorhyncha* has one cervical vertebra more and one lumbar less than the other species. *R. darwini* is restricted to Eastern Patagonia and Southeastern Argentina; *R. macrorhyncha* to the provinces of Pernambuco and Bahia; while *R. americana* ranges from Bolivia and Matto Grosso to Uruguay, but does not seem to occur in the south-eastern provinces of Brazil. In *R. darwini* the neck is shortest, the forelimb longest, the toes longest, the bill shortest, the scutes on the metatarsus fewest. This is thus the most distinct species, yet the long neck and slender head of *R. macrorhyncha* are sufficient to distinguish it.——Mr. Sclater has described a new Phasianus from Northern Afghanistan. The wings have a patch of white, and the feathers of the belly are

broadly tipped with bright purplish-black.——The third list of birds collected in Ecuador by M. Stolzmann contains twelve new species. L. Taczanowski and Count Berlepsch contribute the article (P. Z. S., 1885), and the latter appends some general considerations on the ornithology of Western Ecuador. This fauna now includes 463 species, besides eighty-five from Pichincha, Nanegal and Quito. Eastern Ecuador must be richer in birds, since Messrs. Sclater and Salvin state that Mr. Buckley collected nearly 800 species there. It also appears that there are but few species peculiar to Ecuador as a whole.——It appears from a note of Professor Owen, that the heart of the Apteryx has characters resembling those of Ornithorhynchus. This is especially the case with the auriculo-ventricular valve.

EMBRYOLOGY.[1]

THE DEVELOPMENT OF ANURIDA MARITIMA GUERIN.—During the latter part of the summer of 1883 I had good opportunities to study the development of this interesting insect at Wood's Holl, Mass., where I found its ova, together with the parent insects, in great numbers under stones along the beach just below high-water mark. This appears to be the same species as is mentioned by Dr. Packard in the U. S. Fish Commission report for 1871 and '72, p. 544. The observations which I have been able to make relate entirely to such changes in the egg as may be noted with reflected and transmitted light, as I did not prepare sections of the eggs at the time. The accompanying plate represents several stages of the development of this type, and I have also figured the adult so that it may be compared with the genera Achorutes, Lipura, Anura, etc., to which it is obviously very nearly allied.

The adults are bluish-gray, and measure about 2.25^{mm} in length; ocelli ten, five on each side; no spring or elater developed in the full-grown insect.

The eggs are quite opaque, or practically so when observed with transmitted light, and measure .36 of a millimeter in diameter. They are dirty yellow in color and not white as are the eggs of Isotoma described by Dr. Packard in his memoir[2] on the development of that genus.

When the young Anurida first leaves the egg it strongly resembles Achorutes in the form of its body, as may be gathered from Figs. 3 and 4, and like the adults of that genus is whitish in color. The bluish, velvety appearance of the integument or cuticula which characterizes the adult does not appear to be developed until some days after hatching, or until one or more ecdyses have been accomplished. The eggs of this species are

[1] Edited by JOHN A. RYDER, Smithsonian Institution, Washington, D. C.

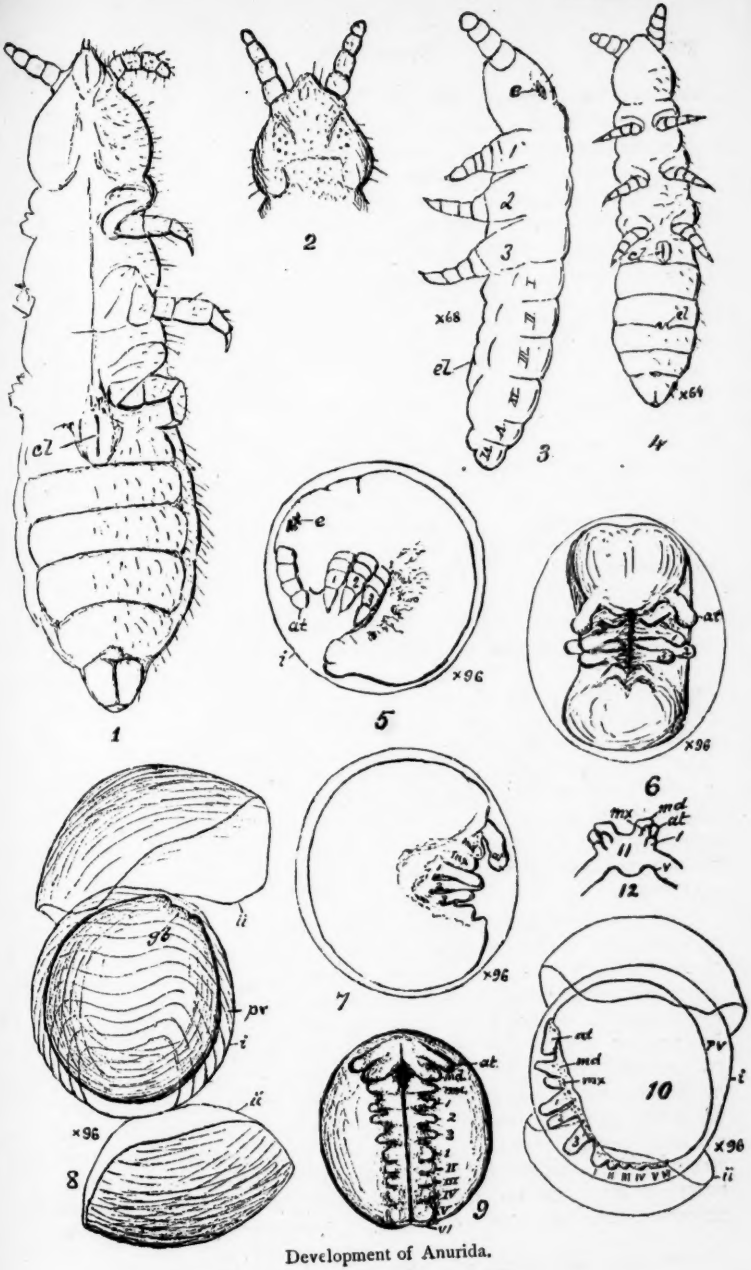
[2] Embryological studies on Diplax, Perithemis and the thysanurous genus Isotoma. Mem. Peabody Acad. Sciences, Vol. I, No. II, 1871, pp. 15–21, plate 3.

also over twice the diameter of those of Isotoma, which measure only about .15 of a millimeter in diameter, so that there is more yolk present and development is much more extremely meroblastic or decidedly epicyemate in character. This will be evident if Figs. 9, 10, 11 and 12 are compared with the earliest stages of Isotoma figured by Packard in the memoir just cited.

One feature in the development of Anurida which has interested me greatly is the presence of a very rudimentary spring or elater, *el*, shown from below in Fig. 4 and from the side in Fig. 3. This appendage, which probably represents a pair of degenerate limbs, is produced from the anterior, inferior part of the fourth abdominal segment, but on the ventral side of the adult no sign of its presence is visible, as may be gathered from an examination of Fig. 1. This organ in Anurida does not arise from the penultimate segment, as in Isotoma, as stated by Packard, but from the antepenultimate or fourth abdominal segment which is in reality the one from which the elater arises in such genera of Collembola, as Lepidocyrtus, Triæna, Tomocerus, etc. In the just-hatched larval Anurida, the elater is developed to exactly the same degree as in *Triæna mirabilis* Tullb., according to Brook.[1] The inference, therefore, is that the springless genera of Collembola are degenerated forms which have descended from others which were provided with well-developed elaters. In fact it is now possible to trace the gradual degeneration of the elater through the genera Achorutes, Xenylla, Triæna and the young of the species under consideration here. Linking this series with those having a more developed elater and tenaculum, and these again with such forms as Campodea and Machilis, we realize what a remarkable series of differential changes the abdominal appendages of the Thysanura and Collembola have undergone, starting probably from the still less modified Symphyla, in which there is no differentiation even between the appendages of the thorax and abdomen.

The earliest stages were not considered, as the ova were too opaque to be studied by transmitted light, and the earliest intimation of the formation of the germ is shown in Fig. 8 at *gb*, the germband being viewed in profile transversely or from one end. The germ-band or ventral plate forms a pronounced thickening which lies on one side of the vitellus, with its longest diameter coinciding with the longer diameter of the egg. This germinal band soon becomes widest anteriorly, as shown by the transverse profile views of it represented by Figs. 11 and 12. From these and a lateral profile view (Fig. 10) of the same stage, I have constructed the diagrammatic representation (Fig. 9) of the germband as it would be seen by reflected light, or as an opaque object, extending over very nearly a semicircumference of the

[1] Journ. Linn. Soc. London, XVII, 1882, pp. 21–22, pl. 7, figs. 11 and 12.



Development of Anurida.

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vitellus. In the later profile (Fig. 10) the germ-band shows the appendages of the embryo developed as follows: the antennæ *at*, the mandibles *md*, the maxillæ *mx*, the three pairs of legs, *1*, *2* and *3*, the collophoral segment, I, and the following abdominal segments up to VI. In the next stage, when it may be said that the embryo is already beginning to lengthen, as shown in Fig. 7, the ventral plate, with its appendages, is no longer convex when viewed laterally in profile, but becomes strongly concave or bent upon itself, and it then appears as if it had been shortened, the embryonic appendages being also much crowded together at their distal ends, as shown in Figs. 6 and 7, which represent the same stage viewed from in front and in profile. In the course of further development the embryo increases still more in length, as shown in Fig. 5, when it may be said that the definitive form of the parent animal begins to be obvious. By this time the limbs and antennæ have become definitely segmented. During the earlier stages the limbs, antennæ, collophore, etc., had the form of mere blunt, paired papillæ, or of blunt, clavate, tentacle-like paired outgrowths from the lateral surfaces of the ventral plate or elongated germinal area.

The changes which determine the appropriation of the yolk, or whether a dorsal organ is developed which takes part in this or not, as held by Korotneff in the case of Gryllotalpa, are points which have not been made out. This, as well as the manner in which the blastoderm is formed, can only be made out by means of sections.

The eggs, as well as the adult animals, are not readily wetted with water or even in dilute alcohol. I have succeeded in hardening them by treating them first with weak alcohol and afterwards placing them in dilute chromic acid or Müller's fluid.

The egg of this species, after the formation of the germinal plate, is invested by an inner covering, *i*, and an outer one, *ii* as shown in Figs. 8 and 10. By very careful manipulation under a compressor the outer one may be ruptured, when it will be discovered that the inner one is wrinkled in the most singularly symmetrical fashion, as represented in Fig. 8. Whether this second wrinkled covering is the serous envelope or amnion I am not certain. It may be that it is a cuticular chitinous secretion from the cells of the blastoderm, such as has been found by Kingsley[1] to invest the embryo of Limulus while yet in the egg. Inside the second egg-envelope, and between it and the ovum proper, there is a very considerable perivitelline space, *pr*, developed.

Imperfect as these notes are, I publish them, first, because the development of this form differs greatly in its external features from that of Isotoma, described by Packard; secondly, because the development of this type recapitulates very briefly the devel-

[1] Notes on the embryology of Limulus. Quart. Journ. Mic. Sci., Oct., 1885.

opment of the elater, so characteristic of the Collembola, indicating, as it seems to me, that that organ, in the genera in which it is absent or rudimentary, has been lost through degeneration; and thirdly, because the egg is more decidedly meroblastic or teleplasmic than that of Isotoma.—*John A. Ryder.*

PHYSIOLOGY.[1]

REPORT OF COMMITTEE ON DISINFECTANTS OF THE AMERICAN PUBLIC HEALTH ASSOCIATION.—A little more than a year ago the Public Health Association, stirred up by the prospective speedy advent of cholera in this country, took steps to arm both practitioners of medicine and the public at large against not only that disease but all ailments supposed to owe their existence to "germs." A committee was appointed consisting of Drs. Sternberg and Smart, of the Army, Raymond, of Brooklyn, Vaughan, of Ann Arbor, Leeds, of New Jersey, Watkins, of New Orleans, and Rohé, of Baltimore, to investigate the efficiency of the various obtainable germicides and antiseptics in respect to sanitation and preventive medicine. Probably no more competent and conscientious workers than are some, if not all of the members of this committee, could have been chosen to carry out this difficult undertaking. The report opens by clearing away a common confusion of terms. An *antiseptic* is a substance which simply prevents or arrests the development of bacterial organisms; a *disinfectant* or *germicide* is a substance which kills them. All disinfectants are antiseptics, but not all antiseptics are disinfectants. The work of the committee was limited to the study of the disinfecting properties of the substances investigated.

The report consists partly of the descriptions of original experiments, and partly of historical essays, embodying the results of the most trustworthy investigators in this field. The general reader would search in vain the mass of bacteria literature to find some definite idea of the comparative value of different disinfectants; but in the work before us the confusion is reduced to a minimum, because the many different substances investigated are considered from the same standpoint and after the same methods. It means very little when one experimenter declares that chromic acid, for example, is an antiseptic in the proportion 1 : 1000, and another that carbolic acid has the same power when of the strength 1 : 500; for the more concentrated the strength of the germ-food solution the greater must be the concentration of the antiseptic to be efficient, and a percentage of antiseptic, that would prevent the development of germs for the space of three days, might be lived down by bacteria in the course of six.

Mercuric chloride as a disinfectant easily stands at the head of substances readily obtainable. As this substance is a violent

[1] This department is edited by Professor HENRY SEWALL, of Ann Arbor, Michigan.

poison objection has been made to its use that when thrown into vaults it might soak through the earth and contaminate the drinking water in wells or cisterns; Dr. Vaughan, however, has shown that when solutions of mercuric chloride are filtered through various kinds of soil, the filtrate contains no trace of mercury; the bichloride having probably been decomposed in the earth, the mercury forming insoluble salts with carbonates and phosphates with which it has come into contact. Its destructive action on lead pipes presents one important objection to the domestic use of the mercury salt. Some bacterial organisms reproduce themselves by means of spores, and these latter are very much more resistant toward germicidal influence than are the active organisms. The conclusions arrived at by the committee are of so great practical importance and are so concisely stated that they will be stated here nearly *in extenso*.

The most useful agents for the destruction of spore-containing infectious material are: 1. *Fire.* Complete destruction by burning. 2. *Steam under pressure.* 110° C. (230° Fahr.) for ten minutes. 3. *Boiling in water* for one hour. 4. *Chloride of lime.* 1 to 4 per cent solution. 5. *Mercuric chloride.* A solution of 1 : 500.

For the destruction of infectious material which owes its infecting power to micro-organisms *not containing spores*, the committee recommends: 1. *Fire.* Complete destruction by burning. 2. *Boiling in water* half an hour. 3. *Dry heat.* 110° C. (230° Fahr.) for two hours. 4. *Chloride of lime.* 1 to 4 per cent solution. 5. *Solution of chlorinated soda.* 5 to 20 per cent solution. 6. *Mercuric chloride.* A solution of 1 : 1000 to 1 : 4000. 7. *Sulphur dioxide.* Expose for twelve hours to an atmosphere containing at least 4 volumes per cent of this gas, preferably in presence of moisture (this requires the combustion of 3 to 4 lbs. sulphur for every 1000 cubic feet of air space). 8. *Carbolic acid,* 2 to 5 per cent solution. 9. *Sulphate of copper,* 2 to 5 per cent solution. 10. *Chloride of zinc,* 4 to 10 per cent solution.

The committee would make the following recommendations with reference to the practical application of these agents for disinfecting purposes:

For excreta.—(*a*) In the sick room: For spore-containing material. 1. Chloride of lime in solution, 4 per cent. 2. Mercuric chloride in solution, 1 : 500 (the addition of an equal quantity of potassium permanganate as a deodorant and to give color to the solution is recommended). In the absence of spores; carbolic acid in solution, 5 per cent. 4. Sulphate of copper in solution, 5 per cent. 5. Chloride of zinc in solution, 10 per cent. (*b*) In privy vaults; mercuric chloride in solution, 1 : 500. Chloride of lime in powder (it is well to dilute by mixing with plaster of paris or clean sand).

For clothing, bedding, etc.—(*a*) Soiled underclothing, bed linen, etc. 1. Destruction by fire, if of little value. 2. Boiling for at least half an hour. 3. Immersion in solution of mercuric chloride

of strength 1 : 2000 for four hours. 4. Immersion in a 2 per cent solution of carbolic acid for four hours. (*b*) Garments which would be injured by the above treatment: 1. Exposure to dry heat at a temperature of 110° C. (230° Fahr.) for two hours. 2. Fumigation with sulphurous acid gas for at least twelve hours, the clothing being freely exposed and the gas present in the disinfection chamber in the proportion of 4 volumes per cent. (*c*) Mattresses and blankets soiled by the discharges of the sick: 1. Destruction by fire. 2. Exposure to super-heated steam—25 lbs. pressure—for one hour (mattresses to be freely opened). 3. Immersion in boiling water for one hour. 4. Immersion in solution of mercuric chloride and sulphate of copper.

Furniture and articles of wood, leather and porcelain, washing, several times repeated, with: 1. Solution of mercuric chloride 1 : 1000. 2. Solution of chloride of lime, 1 per cent. 3. Solution of carbolic acid, 2 per cent.

For the person.—The hands and general surface of the body of attendants, of the sick and of convalescents at the time of their discharge from the hospital: 1. Solution of chlorinated soda 1 to 9 of water. 2. Carbolic acid, 2 per cent solution. 3. Mercuric chloride 1 : 1000; the latter recommended only for the hands or for washing away infectious material from a limited area, not as a bath for the entire surface of the body.

For the dead.—Envelope the body in a sheet thoroughly saturated with: 1. Chloride of lime in solution, 4 per cent. 2. Mercuric chloride in solution, 1 : 500. 3. Carbolic acid in solution, 5 per cent.

Recent Investigations on the Respiratory Center.—Our knowledge of the respiratory center dates from the work of Le Gallois, in the early part of this century. He located this center in the medulla oblongata, confining it indeed to a very limited portion of the medulla in the region of the origin of the vagus nerve. Flourens repeated Le Gallois's experiments and localized the center to a small spot in the gray matter at the level of the calamus scriptorius which he named the "nœnd vital." Later workers demonstrated that the respiratory center of the medulla is bilateral. Longitudinal sections along the middle line of the medulla do not prevent the respiratory movements from taking place. No part of physiology seems to have been more generally accepted than the existence of this center in the medulla, though its exact position has always been and is still a matter of controversy. In 1873 Gierke made a thorough investigation of the subject, his method being to make lessons of different portions of the medulla, as narrowly localized as possible; and after observing the effects of his section to harden the medulla and study the lesion by means of microscopic sections. He found that destruction of a small area in the region of the end of the calamus scriptorius on both sides was followed by a complete cessation of the respira-

tory movements. Microscopic study of this region convinced him that the spot whose destruction had this effect was a bundle of nerve fibers lying outside of the nucleus of the spinal accessory nerve and below the nucleus of the posterior pyramid. This result was of course very unsatisfactory. According to the present conceptions of physiologists nerve centers must always consist of nerve cells, and it is not conceivable that automatic stimuli can arise in nerve fibers. If investigations had rested here this collection of fibers could only be looked upon as the efferent fibers from a center whose location had not yet been determined.

Other physiologists have denied the existence of a respiratory center in the medulla, altogether holding that the centers governing the respiratory movements are situated in the spinal cord. While others have described respiratory centers in the floor of the third ventricle, or in the corpora quadrigemina in the gray matter surrounding the aqueduct of Sylvius. Two interesting communications on this subject have appeared recently in the Centralblatt f. Med. Wiss., Nos. 27 and 34, 1885. Unfortunately these investigations have given different results, so that we are still left in doubt as to the location of the medullary center, though it looks as if the problem was very near its final solution. The first communication, No. 27, is by Mislawsky. He states that Gierke's bundles have nothing to do with the respiratory movements. Injury to them in any part of their course does not prevent respiration. He localizes the respiratory centre in a number of nerve cells forming an irregular group on either side of the raphe, lying between it and the root of the hypoglossal nerve. The boundaries of this center lie between the base and point of the calamus scriptorius, from before back, and in a dorso-ventral direction between the olives and the gray substance of the floor of the fourth ventricle. Destruction of this centre on both sides completely stops the respiratory movements, while injury to one side affects the respiratory movements of that side alone. The efferent fibers from this center to the spinal origin of the nerves of the respiratory muscles lie outside of Gierke's bundle. In No. 347 of the Centralblatt, Gierke replies to Mislawsky's criticism. He states positively that the group of cells described by Mislawsky as the respiratory center does not exist; that the locality assigned to it is occupied entirely by the reticular formation, and it is the scattered cells of this formation which Mislawsky has mistaken for a definite nerve center. The disposition of the nerve cells in the reticular formation he finds to be very irregular in different mammalia, and in no case was there any collection of these cells that could be differentiated from the remaining cells of the formation.

Gierke states that his latest investigations have convinced him that the bundle of fibers previously described by him as the respiratory center contains in its whole extent a number of nerve

cells, and these cells are in connection with the fibers of the bundles. This discovery takes away the theoretical objections to Gierke's previous results, and if his work can be corroborated will place the existence of a medullary respiratory center upon a satisfactory experimental basis.

Both communications are preliminary to more extensive papers, shortly to be published.—*W. H. Howell, Johns Hopkins University.*

PSYCHOLOGY.

Intelligence of Anthropoid Apes.—In his excellent work on anthropoid apes, Professor Hartman, the Berlin zoölogist maintains that anthropoid apes in nature "develop an intelligence which sets them high above the other mammals. They do not, however, display the keenness of scent and quickness of sight which distinguish some animals of a lower order, such as canine beasts of prey and ruminants manifest in many different ways. The structure of their nests is rude in comparison with that of some other mammals—as for example, of rodents. But we must not forget that several of the lower races of men, such as the degraded Bedja, the Obongo, the Fuegians, many aborigines of the Brazilian forests and the Australian black, scarcely rise above the inartificial structure of an anthropoid's nest in the construction of their huts."

The author quotes Falkenstein's description of a gorilla: "His good-humor and shyness, or rather roguishness, deserves special mention as his strongest characteristic. When he was chastized, as it was necessary to do at first, he never resented the punishment, but came up with a beseeching air, clinging to my feet, and looking with an expressive air which disarmed all displeasure. When he was anxious to obtain anything, no child could have expressed its wishes in a more urgent and caressing manner. If in spite of this he did not obtain what he wanted, he had recourse to cunning, and looked anxiously about to see if he was watched. It was just in these cases when he obstinately pursued a fixed idea, that it was impossible not to recognize a deliberate plan and careful calculation. If, for example, he was not allowed to leave the room, or, again, was not allowed to come in, he would, after several attempts to get his own way had been baffled, apparently submit to his fate, and lie down near the door in question, with assumed indifference. But he soon raised his head in order to ascertain whether fortune was on his side, edging himself gradually nearer and nearer, and then, looking carefully round, he twisted himself about until he reached the threshold; then he got up, peered cautiously round, and with one bound galloped off so quickly that it was difficult to follow him.

"He pursued his object with equal pertinacity when he felt a desire for the sugar or fruit which was kept in a cupboard in the eating-room; he would suddenly leave off playing and go in an

opposite direction, only altering his course when he believed that he was no longer observed. He then went straight to the room and cupboard, opened it, and made a quick and dexterous snatch at the sugar-box or fruit-basket, sometimes closing the cupboard doors behind him before beginning to enjoy his plunder, or, if he was discovered, he would escape with it, and his whole behavior made it clear that he was conscious of transgressing into forbidden paths. He took a special, and what might be called a childish pleasure in making a noise by beating on hollow articles, and he seldom omitted an opportunity of drumming on casks, dishes or tin trays, whenever he passed by them—a noisy amusement to which he was much addicted during our homeward voyage on board the steam-vessel, in which he was at liberty to roam about.

"Mafuca, for a while, was pleased with the companionship of a pretty sea-cat monkey, but she teased the creature so much that a special refuge was set apart for it, into which she could not enter. She was so scared and terrified by a heavy thunder-storm that she seized her sleeping playfellow by the tail and dashed it to the ground. She chased the mice which ran about the cage with deadly fury. She was much afraid of snakes, which is not usually the case with chimpanzees. If she was left alone any time she tried to open the lock of her cage without having the key, and she once succeeded in doing so. On that occasion she stole the key which was hanging on the wall, hid it in her axilla and crept quietly back to the cage. With the key she easily opened the lock, and she also knew how to use a gimlet. She would draw off her keeper's boots, scramble up to some place out of reach with them, and throw them at his head when he asked for them. She could wring out wet clothes and blow her nose with a handkerchief. When her illness began, she became apathetic, and looked about with a vacant, unobservant stare. Just before her death, from consumption, she put her arms round Schöpf's neck when he came to visit her, looked at him placidly, kissed him three times, stretched out her hand to him, and died. The last moments of anthropoids have their tragic side."

Dr. Preyer's Criticism of Telepathy.—Professor Preyer, of Jena, well known through his researches into hypnotism, the development of the infant mind, etc., does not believe in telepathy, and attempts in a twenty-page article to give the readers of the January *Rundschau* the reasons for his skepticism. His criticisms are confined to the Proceedings of the Society for Psychical Research in London, which in September, 1882, numbered 100, and a year ago 520 members, including 140 women. With truly German contempt for the feminine intellect, Dr. Preyer remarks that "the large number of female members and participators shows at the very outset that a strictly scientific spirit cannot be regarded as underlying the society's proceedings." But since the society has assumed such large dimensions as to have its special head-

quarters and a library, and since it includes among its active or honorary members such names as Balfour Stewart, Lord Rayleigh, Professor Bowditch, Mr. Crookes, and Mr. A. R. Wallace, Preyer thinks it worth while to examine their proceedings critically, so as to caution his countrymen against these useless proceedings, and prevent, if possible, the formation of a similar society in Germany. Preyer's analyses of a number of the 600 reported cases of telepathy are exceedingly ingenious and subtle. Though he concedes that the *possibility* of thought transference cannot be disproved, he makes out a good case that the experimenters ignored sources of error which vitiate their conclusions. Especially ingenious is his explanation of the countless ways in which the two persons to be examined can communicate with each other, if in the same or adjoining rooms—as by means of different noises made in breathing through the mouth or nose, movements with the foot, gnashing of the teeth, etc.; remembering at the same time that individuals, owing to great nervous susceptibility or to training, are endowed with as abnormal acuteness of the senses as are hypnotized persons. In Liverpool, for example, two girls were examined who claimed that one could tell what the other ate, if the latter was allowed to put her hand on the former's shoulder. Aside from the fact that there might have been a prearranged alphabet of signs through pressure on the shoulder, there was the probability that one of the girls had a very acute sense of smell. The result showed that in thirty-two trials only six answers came out correct, and in five of these cases the substance used had a strong odor. In other instances, where one of the persons under examination puts the question himself to the other, Preyer points out that the whole secret may be betrayed by special accents placed on certain words, in the same way that dogs can be taught to pick out certain cards, to add and subtract, by emphasizing certain words. The cases of alleged action of one mind on another, at greater distances, Preyer regards as either due to coincidence, to fraud, to hallucinations, to incorrect reporting, or to lack of accurate observation, which, always difficult, is more especially so in the region of psychic phenomena. In conclusion, he points out that savages ascribe nothing to chance, while with progressive civilization we see more and more how many that appear to be related as cause and effect are mere coincidences.—*The Nation.*

MENAULT'S INTELLIGENCE OF ANIMALS.[1]—This is a very readable and pleasantly illustrated book, filled with anecdotes of animals of all grades, from ants to apes. When the original book appeared we do not know, but in his accounts of ants, Menault does not mention the recent writings of Forel, Lubbock or McCook;

[1] Wonders of Man and Nature. The Intelligence of Animals, with illustrative anecdotes. From the French of Ernest Menault. Illustrated. New York, Charles Scribner's Sons, 1885, 12mo.

and in other portions Morgan's work on the beaver, or Romanes' excellent book do not seem to have been known to the author or his translator. Indeed the authors quoted are largely French, though the recent remarkable papers and books of Favre are not referred to. The book is not therefore to be classed with the more critical and authoritative works of the authors which we have named, though it is a very interesting collection of anecdotes which throw more or less light on the mental powers of animals, particularly of those domesticated by man. The cuts are attractive, but that of the "chimpanzee at table," carving with a knife and fork, and filling his glass from a bottle held *in a tight coil of his tail*, represents a creation of the studio rather than a result of the processes of evolution *in re* tails.

ANTHROPOLOGY.[1]

ANNUAL REPORT OF THE BUREAU OF ETHNOLOGY.—The third annual report of the Bureau of Ethnology, covering the fiscal year 1881–'82, and bearing the imprint of 1884, has just appeared. The volume consists of the report of the director, Major J. W. Powell, and scientific papers by Thomas, Dall, Matthews, Dorsey, Holmes and Stevenson.

Major Powell's report reviews the work of the Bureau in the field and in the office, epitomizes the scientific papers in the volume, and closes with a very suggestive chapter on activital similarities. The resemblances which have been noticed in human arts and inventions throughout the world arise, according to the essay, in the four following ways:

Autogenous similarities { Due to concausation. / Adventitious.

Syngenous similarities { Due to cognation. / Due to acculturation.

That is, things may arise independently from similar causes; they may be similar merely by accident; they may have come about through the same race or their descendants; or one people may have learned them from another.

The chapter concludes with nine rules, for the discovery of which one of the causes has been active in any case.

Mr. Thomas' paper, entitled Notes on certain Maya and Mexican Manuscripts, is a comparison of two plates in the Codex Cortesianus with the Mexican calendar systems to show the connection between the two. The author says: "That all the Central American nations had calendars substantially the same in principle as the Mexican, is well known. This of itself would indicate a common origin not so very remote; but when we see two contiguous or neighboring peoples making use of the same conventional signs of a complicated nature, down even to the most minute details, and those of a character not comprehensible by

[1] Edited by Prof. OTIS T. MASON, National Museum, Washington, D. C.

the commonalty, we have proof at least of a very intimate relation. One thing is apparent, viz., that the Mexican symbols could never have grown out of the Maya hieroglyphics. That the latter might have grown out of the former is not impossible."

Mr. Dall's paper treats of masks, labrets and certain aboriginal customs, with an inquiry into the bearing of their geographical distribution. His classification of masks is as follows:

1. The mask, having breathing and peep holes.
2. The maskette, without perforations.
3. An object resembling a mask, but not to be worn.

In an evolutionary series masks would be arranged thus:

A. For defense.
  a. Passive, culminating in the helmet.
  b. Active, awe inspiring, culminating in shaman masks.
B. Symbolical.
  a. Illustrative.
  b. Ritual.

The author, after a very elaborate treatment of the subject, illustrated by numerous figures, closes with some observations upon the origin of labretifery and mask-wearing in America, which apparently called forth Major Powell's essay on activital similarities. Rejecting Northern Asia and the Atlantis theory, holding as extremely improbable the theory of similar causes acting to produce similar effects, Mr. Dall concludes that the great congeries of islands, known as Polynesia and Melanesia, offer the most plausible solution of the problem.

Dr. Matthews has a short paper beautifully illustrated and perfect of its kind. That is to say, the author has described the Navajo weaver so accurately and minutely that any hand-loom weaver could read the description and produce a Navajo blanket or belt. It is so refreshing to read a description of aboriginal art by one who knows aught about it that, even at the risk of flattery, we cannot refrain from the foregoing just encomium.

There are three kinds of Navajo blankets in the National Museum. The first, or oldest, is aboriginal work, from the raw, dirty, native wool to the finished robe. This the author describes. The second is partly native and partly of raveled strouding or traders' blankets. The third is a modern invention. Germantown wools, not always well dyed, are furnished to the weaver, and he executes patterns to order. These, though held at high price, are inferior in every way; the colors fade, and run if wet in the least.

Mr. Dorsey's paper on Omaha sociology, the longest in the volume, is also the most elaborate and the most learned. The author discusses the social system of the Omaha tribe of the great Sioux stock in the following order:

1. The state, its classes and corporations.
2. The Gentile system, including tribal circles, sacred tents, sacred pipes, the several gentes minutely described.
3. The kinship system and marriage laws, giving classes of consanguines, the laws of marriage and remarriage.

4. Domestic life, courtship, marriage customs, etiquette, bashfulness, pregnancy, children, position of women, catamenia, widows and widowers, rights of parents, personal habits, politeness, meals, etc.
5. Visiting customs.
6. Industrial occupations, hunting, fishing, agriculture, food, clothing, etc.
7. Defensive and offensive warfare.
8. Games, societies, corporations, etc.
9. The government and religion.
10. Law.

Mr. Holmes' article treats of prehistoric textile fabrics in the United States, derived from impressions on pottery. The process of Mr. Holmes is most ingenious. He takes a cast of the fragments of pottery and that brings out the texture of the cloth or basket by which the soft paste was impressed. It is marvelous that no other archæologist ever thought of this effective scheme. In the application of his casts to modern weaving Mr. Holmes will allow a suggestion. His first group and his fourth group are the same, the one being plain, checker weaving, the other, weaving in diagonal or diaper. His second group and his third group are absolutely identical, appearing on the same piece in many modern examples. His elaborate schemes of weaving this pattern are also unnecessary, the warp being mistaken for the weft, and very complicated machinery substituted for a stick set up in the ground, as any one may see who will visit the basket makers in Queen Charlotte archipelago.

Group five may represent four-ply braiding, but it is just as likely to belong to group two, although the Tlinkits understand four-ply braiding.

We may be allowed a word as to the spread of textile industry at present among the North Americans in its relation to Mr. Holmes' paper. Types one and four are practiced by all Indians east of the Rocky mountains, north and south. If Mr. Holmes' figs. 65, 107, 108 and 109 are coiled basketry (and they look very much like the Pai Ute pitched water jars) this style is still practiced by the North Carolina Cherokees, and by the Eskimo, Athapascan, Californian, Pueblo, Apache, Navajo, Yuma and Pima tribes. Mr. Homes' twined ware, groups two and three, is made now by the Winnebagos east of the Rockies, and by the Eskimo, Tlinkit, Haida and Chimsyan tribes as well as by those of Washington Territory, Oregon, Northern California, and by the Shoshonis and Pueblo tribes. It is not now known among any of the tribes who have of late been identified with the mound-builders.

The illustrated catalogues at the end of the volume are extremely useful to the student. The practice of printing a great mass of numbers, conveying no information, which very much marred Vol. II of these reports, has been less followed here. The illustrations of the volume, especially those last executed, are excellent, and the appearance of the whole work does credit to the editor in charge.

THE CRANIA OF NEGROES.—Although published in 1884, C. Passavant's Craniologische Untersuchung has just come to hand. His results are given both in tables and in graphic charts, the former are here combined:

Indices.	*Whole No. African crania.*	*Hottentots and Bushmen.*	*Kaffirs.*	*Congo.*	*Nigritians.*	
64	3	—	1	—	2	
65	1	—	1	—	—	
66	4	—	1	2	1	
67	3	2	—	1	—	
68	5	1	2	1	1	
69	3	—	1	1	1	Dolicocephals.
70	13	1	4	4	4	
71	15	2	6	3	4	
72	19	2	4	7	6	
73	21	4	7	5	5	
74	21	2	3	10	6	
75	27	5	8	8	6	
76	24	4	2	10	8	
77	20	8	1	10	1	
78	6	1	—	5	—	Mesocephals.
79	6	—	—	5	1	
80	6	—	—	4	2	
81	2	—	—	2	—	
82	1	—	—	1	—	
83	2	—	—	2	—	Brachycephals.
84	2	—	—	2	—	
85	1	—	—		1	
	205	32	41	83	49	

From this table it will be seen that all indices may be found in Africa, that the Congoese are the shortest headed, and that the mass of the whole or of any class will be found between 70 and 80. The same would probably be true on any other continent, showing that Dr. Topinard's application of the results of cranial index as an evolutionary characteristic is probably correct.

LACUSTRIAN ANTIQUITIES OF DR. GROSS.—Archæologists and antiquarians traveling on the European continent will be pleased to hear that the celebrated collection of *lacustrian* antiquities of Dr. Gross of Neuveville, on the Lake of Brenne, was presented by the proprietor to the Swiss confederacy, and is now on exhibition in the federal palace at Berne, the capital. All the different periods are well represented, and there are over 5000 pieces making up the collection, many of them being unique. There are one hundred objects of nephrite and jadeite, one hundred and fifty bracelets and anklets, one hundred knives, sixty hatchets, a large array of objects in silex and bronze, pottery molds, vases, and skulls from several Swiss lakes. In the same hall are

suspended the two paintings of Bachelon, "Domestic Life of the Lake Dwellers." Berne also possesses a civic museum for antiquities, and other well-assorted collections of this kind may be found in Brenne, Zürich, Neufchâtel, Geneva and Freiburg.—*A. S. Gatschet.*

RECENT ARTICLES BY DR. TSCHUDI—We have before us a series of recent articles composed by the Peruvian traveler, Dr. J. J. von Tschudi, who at present employs himself in making digests of ethnologic material previously collected. These papers are partly of an anthropologic, partly of a topographic or linguistic import. Among the latter we mention: "Die geographischen Namen in Peru," eight pages, in *Kettler's Geographic Magazine;* "Remarks on Lopez's communication on the tribe of the Calchaqui Indians," in the Argentine Republic (Zeitsch. f. Ethnologie, 1885), in which v. Tschudi lays stress upon the total disparity of the tribe spoken of with the Kechuas in their language; "Das Lama in seinen Beziehungen zum altperuanischen Volksleben" (Zeitschr. f. Ethnologie, 1885, pp. 93–109), a very instructive treatise, based alike on history and on the author's own ethnographic and local investigation. The extensive terminology of the Indians to designate all kinds of young, old, spotted, etc., lamas is of peculiar interest to the linguist.—*A. S. Gaschet.*

SUPPLEMENT TO THE GRAMMAR OF THE CAKCHIQUEL LANGUAGE.—Dr. Otto Stoll, a physician of Zürich, Switzerland, who has lived five years among the Indians of Guatemala, has written some important "Supplementary remarks to the grammar of the Cakchiquel language, edited by Dr. D. G. Brinton." This article was read before the American Philosophical Society of Philadelphia, February 6, 1885, and printed in its Proceedings. Stoll's remarks form a series of rectifications and criticisms upon the antiquated method followed by the ancient ecclesiastics in writing up grammars of the American languages, and the frequent misapplications in their terminology. As to the name Cozumelguapan, Stoll thinks it is of Nahuatl origin, and quotes the etymology of Buschmann, "Near the rainbow water." He may rest assured, that only the local ending -pa, -pan is Nahuatl, and that *cozumel* is a Maya word, signifying *swallow.*—*A. S. Gatschet.*

MICROSCOPY.[1]

NATURAL INJECTION (Leeches).—I have often noticed that leeches hardened in weak chromic acid, or in any chromic solution, are beautifully and naturally injected with their own blood. Where the circulatory system is to be studied by means of sections, this method seems to be the simplest and most reliable one. Not only the larger sinuses, but the intra-epithelial capil-

[1] Edited by Dr. C. O. WHITMAN, Mus. Comparative Zoology, Cambridge, Mass.

laries, may be easily traced by this method, as was first pointed out by E. Ray Lankester.[1]

METHODS OF INJECTING ANNELIDS (Maurice Jaquet).[2]—For annelids with dark tissues like Hirudo, a light-colored (white or yellow) injection-mass should be employed, while for transparent animals dark colors are preferable. Chrome yellow serves as a good coloring substance. It is easily obtained by mixing solutions of bichromate of potassium and acetate of lead. A copious yellow precipitate is formed, which should be washed on the filter, and then exposed to the air until nearly dry. The pigment, after being reduced to a pulp-like state, is added to an ordinary aqueous solution of gelatine; and the mass is then filtered warm through linen. If the injection-mass is to be blue, then the gelatine may be dissolved directly in liquid Prussian blue, and the mass filtered through the paper.

As a rule, annelids must be killed before they can be injected. Chloroform and alcohol are the means commonly employed in killing for the purpose of injection; fresh water may also be used for some marine species. A leech, for example, is placed in water containing a small quantity of chloroform; after a few moments it sinks to the bottom and remains motionless. It should be allowed to remain in the water from one to two days before attempting to inject it.

The simplest and most convenient form of syringe consists of a glass tube drawn to a fine point at one extremity, and furnished at the other with a rubber tube. Preparatory to injecting, the glass should be plunged in warm water for a few moments; then, after expelling the water, it may be filled with the injection-mass by sucking the air from the rubber tube. If the injection-mass is turned into the large end of the glass, it may happen that granules are introduced which are large enough to obstruct the narrow passage of the small end. After inserting the cannular end in the vessel, clasp both with the forceps, and then force the injecting fluid, by aspiration through the rubber tube, which is held in the mouth. When the operation is completed, place the animal in cold water, in order to stiffen the injected mass.

AN INJECTION-MASS TO BE USED COLD.—[3]

Borax (saturated solution)	1 part.
Gum arabic	2 parts.

The solutions are best made in hot water. The mixture of the solutions gives a gelatinous mass that is nearly insoluble in water. The mass is broken up into small pieces and a little water added, and then pressed through linen. A thick fluid is thus obtained, which, with the addition of a little more water, must again be

[1] Quart. Jour. Mic. Sc., XX, July, 1880, p. 306.
[2] Mitth. a. d. Zoöl., Station z, Neapel, VI, H. 3, p. 298, Dec. 1885.
[3] A. K. Bjelousson, Arch. f. Anat. u. Phys. (Anat. Abth.), 1885. H. 5 and 6, p. 379.

passed through linen. This fluid may be kept for months, and is readily thinned to any desired consistency by the addition of water. Before using, it should be tested with alcohol. A small quantity is placed in a test-tube, and then a little alcohol added. The fluid is at once changed to a solid mass of double the original volume, and this mass is insoluble in water.

Thus the whole process consists in this: that borax and gum arabic form together an insoluble colloid mass; by pressure through linen, with water added, the mass passes into a fluid condition which can be diluted to any extent with water; after injection and immersion of the preparation in alcohol, it again assumes a colloid condition in which it is insoluble in water.

The mass thus prepared may be colored with finely powdered carmine, or with other coloring substances; only cobalt and cadmium are to be avoided.

This mass is especially recommended for macroscopic injections, and for the injection of lymphatic spaces. The injected vessels do not become hard, and the mass does not escape from ruptured points. During dissection the preparation should be covered with alcohol.

In case it becomes desirable to dissolve the injected mass from any part of the vessels, this can be accomplished by dropping dilute acetic acid upon it.

The preparation can be rendered transparent by first washing with water, and then soaking in glycerine. Treatment with alcohol again restores the opacity of the preparation.

METHOD OF KILLING GEPHYREA.—According to Apel[1] the only method of killing these animals, in an extended condition, is by the use of hot water. The animal may be placed in a vessel of sea water, and the temperature gradually raised to about 40° C; or it may be seized by a pair of forceps while in a condition of extension, and plunged for a moment into boiling water. This latter treatment does not kill the animal, but renders it completely limp, in which condition it should be cut open and then placed in some hardening fluid.

A MACERATING MIXTURE (central nervous system of vertebrates).—The following mixture, discovered by Landois, is recommended by Hans Gierke[2] as an excellent macerating agent, especially for the central nervous system of vertebrates:

Chromate of ammonium	5 g.
Phosphate of potassium	5 g.
Sulphate of sodium	5 g.
Distilled water	100 g.

Pieces of fresh-tissues are left in this fluid from one to three, or even four to five days, then transferred to a mixture (in equal parts) of this fluid with ordinary ammonia-carmine (24 hs.).

[1] Zeitschr. f. wiss. Zool., XLII, H. 3, p. 461, 1885.
[2] Arch. f. Mik. Anat., XXV, H. 4, p. 445, Oct., 1885.

HALLER'S MACERATING FLUID[1] (central nervous system of marine Rhipidoglossa).—

Glycerine	5 parts.
Glacial acetic acid	5 "
Distilled water	20 "

This fluid causes no shrinkage, and accomplishes its work in one-half to three-quarters of an hour.

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SCIENTIFIC NEWS.

PRINCETON, Feb. 16, 1886.

PROFESSOR E. D. COPE, EDITOR AMERICAN NATURALIST.

Dear Sir:—In the February number of the NATURALIST you say with regard to Professor Marsh's *Tinoceras stenops*, formerly referred by you to a new genus Tetheopsis: "I now learn on good authority that the symphyseal region in the specimen in question is entirely constructed of plaster of Paris." As I am the one from whom you derived this information, I feel bound, as a matter of simple justice, to correct the above statement, for having just reëxamined the specimen with great care, I find that I was in error in a very important respect. It is true that the left half of the symphyseal region (the only part visible when I first saw the specimen) is restored in plaster, but the right half is intact, and the restoration and drawing were made from that, a perfectly legitimate proceeding. So much I can positively state of my own knowledge, and I am also informed that the restoration was made after the time when you saw the specimen and after Professor Marsh's figure was published. Hoping that you will give this correction a conspicuous place, I remain,

Very respectfully yours, W. B. SCOTT.

[*Note on the above.*—I gladly give place to the above correction, but must append a little additional information. I saw the type specimen of *T. stenops* before 1885, probably in 1883. It was then half imbedded in a mass of what I supposed to be matrix, and the left side of the skull was exposed. The mandible of that side was at that time entire, as represented in Professor Marsh's plate. It exhibited a narrow entire alveolar edge without trace of alveoli or of weathering. What has become of this left half of the symphysis we are not informed. If it was the osseous jaw, the genus Tetheopsis is well founded.—*E. D. Cope.*]

— Among the scientific names included in the death-roll of the past year, is that of Thomas Bland, the author of numerous papers, principally on the "Land shells of the Antillean islands and the North American continent." Mr. Bland's labors and investigations included not only the descriptive and systematic, but also the geographical, structural and developmental

[1] Morph. Jahrbuch., XI, H. 3, p. 323, 1885.

aspects of Molluscan life, and his discussion of phenomena, in which these subjects were involved, is marked by judicious and philosophic treatment. He was the coadjutor of Mr. W. G. Binney in various ways, and their names appear side by side in several instances, particularly in the volume on the "Land and fresh water shells of North America," published by the Smithsonian Institution. In 1884, Mr. A. F. Gray compiled and printed a bibliography of Mr. Bland's papers and contributions to this department of natural history. Mr. Bland was born in Nottinghamshire, England, October 4, 1809, and died in Brooklyn, N. Y., August 20th, 1885. His father was a physician and his mother was related to Shepard, the naturalist. He received his education at the Charter House school, London, and had Thackeray for a classmate. Subsequently he studied and practiced law. In 1842, he went to Barbadoes and afterward to Jamaica, where he became acquainted with Professor C. B. Adams, which led to those investigations which gave to Mr. Bland honorable rank as a scientific thinker and worker. In 1862, he came to New York, and this country became his permanent home. He was a most estimable gentleman, courteous and genial, and greatly beloved by all who knew him.—*R. E. C. S.*

— The annual meeting of the Board of Regents of the Smithsonian Institution was held at Washington, Jan 13. The secretary announced that Congress had reëlected Doctors MacLean, Gray and Coppé as regents for six years, and General Meigs in place of General Sherman, resigned. Professor Baird submitted his report for the six months ending June 30, 1885. He also presented a financial statement showing that the receipts of the institution for 1885 amounted to $67,500, and the expenditures to $45,107, leaving a balance of $33,453. Professor Baird presented a statement showing the necessity for a storage building for alcoholic specimens, also for a new building for the museum, as there are enough valuable specimens to fill a second building the size of the present one.

—A telegram from Colima has been received by the Government, stating that on the morning of Friday, the 15th January, another eruption of the volcano occurred, preceded as before by loud detonations. Enormous stones were thrown to a great height, and were plainly visible from the city of Colima, which is twenty-five miles distant. Photographs depicting the volcano at the moment of its greatest activity were taken by the instantaneous process.

— Professor W. W. Bailey writes us that a few years ago there was an interesting discussion in the NATURALIST upon abnormal or unusual food of cats. "Now I have two kittens, both female, one of whom is especially fond of peanuts, cracking and eating them; and *both* of dates. Certainly this is diet unusual enough to be worthy of record."

— A monograph on the recent Brachiopoda by the late Thomas Davidson, LL.D., F.R.S., edited by Agnes Crane, will be issued in three parts, with thirty quarto plates, during 1886, and will form a separate volume of the Transactions of the Linnæan Society of London.

— The Academy of Natural Science in Philadelphia has, by the death of the widow of the late Mr. H. N. Johnson, come into possession of the entire estate as residuary legatee. It is valued at over $50,000, and the available annual income is nearly $1500.

— Dr. Daniel G. Brinton, of Philadelphia, has been announced as the Laureate of the Société Américaine de France for 1886, and awarded the medal of the society for his work on the native tongues of America.

— Dr. Walter Flight, chemist and mineralogist, and assistant in the mineralogical department of the British Museum, died Nov. 6, aged forty-four.

— J. J. de Tschudi, a Swiss naturalist and traveler, author of a work on Peru translated into English, died in January, at the age of sixty-eight.

— Professor John Morris, who held the chair of geology in University college, London, died in January, aged seventy-five.

— P. Harting, the distinguished professor of zoölogy in the University of Utrecht, died Dec. 7.

— *Erratum.*—On p. 171, line 27, for Orthopod *read* Arthropod.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

INDIANA ACADEMY OF SCIENCES.—In accordance with the call issued by the Brookville Society of Natural History, a number of Indiana scientists met at the court-house at Indianapolis, on Tuesday, Dec. 29, 1885, at 2 o'clock P.M. J. P. D. John, D.D., of DePauw University, was made temporary chairman and Amos W. Butler, temporary secretary. O. P. Jenkins, J. C. Branner and S. P. Stoddard, M.D., were appointed a committee on organization. They reported a constitution and by-laws which were adopted. The name selected is Indiana Academy of Science. The objects of the academy are "scientific research and the diffusion of knowledge concerning the various departments of science." The membership is to be confined to persons "engaged in scientific work or in original research." No provision has yet been made for fellowships. The committee on organization reported the following list of officers: president, David S. Jordan, Indiana university, Bloomington; vice-presidents, J. M. Coulter, Wabash college, Crawfordsville, J. P. D. John, DePauw university, Greencastle, Rev. D. R. Moore, Brookville; secretary, Amos W. Butler, Brookville; treasurer, O. P. Jenkins, State Normal School, Terre Haute; librarian, J. N. Hurty, Indianapolis, all of whom were elected. Papers were read giving, as far as possible, a statement of the

present condition of knowledge in the various branches of science, as follows: meteorology, by W. H. Ragan; mammalogy, E. R. Quick; the work accomplished for natural and physical science, Richard Owen, M.D.; papers on C. S. Rafinesque and ichthyology, by D. S. Jordan, M.D.; botany, J. M. Coulter, Ph.D.; physics, Professor J. P. Naylor; lower invertebrates, Professor O. P. Jenkins; entomology, P. S. Baker, M.D.; herpetology, Professor O. P. Hay; mineralogy, Maurice Thompson; geology, R. T. Brown, M.D.; chemistry, Professor R. B. Warder; conchology, Rev. D. R. Moore; statistics, J. B. Conner; ornithology, A. W. Butler; geography, J. T. Scovell; astronomy, Daniel Kirkwood, LL.D.

A committee was appointed to incorporate the academy. The prospects for the future of the academy are very bright; the ablest investigators and best instructors of the State have united without exception to put this new institution on its feet. There will be two meetings each year, one between Christmas and New Year, the other early in the summer; the former will be held at Indianapolis, the latter will be held at different places throughout the State. The next meeting will be held at Brookville, beginning May 20, 1886.

THE AMERICAN COMMITTEE OF THE INTERNATIONAL CONGRESS OF GEOLOGISTS.—This committee met in the Windsor hotel, New York city, on Friday, January 8th, with the president, Professor James Hall, in the chair. There were present Dr. T. Sterry Hunt, Professor J. S. Newberry, Professor C. H. Hitchcock, Professor J. J. Stevenson, Professor Geo. H. Cook, Mr. McGee (representing Major Powell), and Dr. Frazer, the secretary of the Berlin delegates, who was elected the secretary of the meeting, and read his report of the proceedings of the Berlin congress. His action in ordering 300 extras to be struck off by the printer of the journal, and also 300 copies of the color scale to be printed in Berlin to accompany the report, was approved.

It was decided that translations of the reports of the committee on the map of Europe and on the uniformity of nomenclature, together with an abstract of the English committee's report, should with the American committee's report, and under the direction of Dr. Frazer, be distributed among American geologists under conditions which seemed best.

A committee of five was to be appointed to take measures in advance of the London congress to have American views properly represented; to be prepared for discussion of certain subjects, and to ask the congress to meet in America at its next (after the London) session.

After some other minor matters were decided, Professor Hitchcock was selected to apply the international scheme of coloration to an area which has been selected by Major Powell to test various systems on.

The meeting adjourned to meet at the call of the president.

NEW YORK ACADEMY OF SCIENCES, Jan. 18.—The following paper was read: The San Juan mountains of Colorado, by Dr. R. P. Stevens.

Jan. 25.—The Cretaceous flora of North America (with lantern illustrations), by Dr. John S. Newberry.

BOSTON SOCIETY OF NATURAL HISTORY, Jan. 20.—Professor William M. Davis spoke about the "Chinook wind" of the Northwest; and Mr. S. H. Scudder discussed the relationships of the Mesozoic cockroaches.

Feb 3.—The bow and arrow unknown to Paleolithic man, by Professor H. W. Haynes; On the Santhals, an existing aboriginal tribe of Northeastern Bengal, by Dr. S. Kneeland. Photographs of the people and specimens of their singular native ornaments were shown.

APPALACHIAN MOUNTAIN CLUB, Jan. 13.—The officers for the ensuing year were elected, and the reports of the corresponding secretary and treasurer presented. The following papers were read: The ascent of Popocatepetl, by Professor A. S. Packard; The Carter-Moriah path and camp, by Mr. William G. Nowell; Notes on the region east of Wild river, and south of the Androscoggin, by Mr. A. L. Goodrich.

THE CINCINNATI SOCIETY OF NATURAL HISTORY presents a programme of the fifth course of free popular science lectures, as follows: Friday, Jan. 8, 1886, Hudson's bay and its territories, Mr. Wm. Hubbell Fisher; Friday, Jan. 15, Ants and their habits, Professor A. D. Morrill; Friday, Jan. 22, Science in schools, Rev. Geo. M. Maxwell; Friday, Jan. 29, Clarification of water, Professor C. R. Stuntz; Friday, Feb. 5, Gas wells of Ohio, Professor Edward Orton; Friday, Feb. 12, Glacial theories, Professor J. W. Hall, Jr.; Friday, Feb. 19, Our world a type of other planets, Professor Geo. W. Harper; Friday, Feb. 26, Astronomical review, Professor R. W. McFarland; Friday, March 5, An Australian fern-tree forest, Rev. Raphael Benjamin; Friday, March 12, Nebulæ and star clusters, Mr. Wm. H. Knight; Friday, March 19, Experiments in electricity and magnetism, Mr. Geo. F. Card.

CRAWFORDSVILLE SCIENTIFIC SOCIETY.—This society is established in connection with Wabash college, but includes citizens of Crawfordsville interested in scientific subjects. At the December meeting Professor John M. Coulter spoke of some puzzling forms of parasitic fungi recently found growing in a solution of sodium acetate; Professor Dunn brought out a number of valuable points which had come under his observation in studying the habits of the salamander; E. H. Marshall gave the results of a chemical analysis of a valuable clay recently discovered in this county; H. Thomson traced the development of the cerebellum from the lowest vertebrates to the highest; J. N. Rose gave the details of an experiment for showing the transpiration of plants.